DOCUMENT RESUME

ED 362 764 CE 064 870

AUTHOR	Berryman, Sue E.; And Others
TITLE	Building the Middle.
INSTITUTION	National Center for Research in Vocational Education, Berkeley, CA.
SPONS AGENCY	Office of Vocational and Adult Education (ED), Washington, DC.
PUB DATE	Dec 92
CONTRACT	V051A80004-92A
NOTE	113p.
AVAILABLE FROM	NCRVE Materials Distribution Service, 46 Horrabin Hall, Western Illinois University, Macomb, IL 61455 (order no. MDS-408: $6.50; executive summary, order no. MDS-409: $2.25).
PUB TYPE	Information Analyses (070)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	Academic Education; Apprenticeships; Cooperative Education; *Educational Needs; Educational Research; *Educational Strategies; *Evaluation Criteria; Integrated Curriculum; *Job Training; Labor Needs; Magnet Schools; *Noncollege Bound Students; Program Development; Resource Allocation; Secondary Education; *Vocational Education; Work Experience Programs; Youth Employment; Youth Programs
IDENTIFIERS	Cognitive Apprenticeships; School Based Enterprises

ABSTRACT

The United States has no coherent strategy for helping noncollege-bound students develop the competence for middle-level jobs. The need for more emphasis on the needs of noncollege-bound students became apparent during the 1980s as less-educated workers began encountering more wage and employment difficulties and as occupations requiring higher-skilled workers began growing faster than those relying on lower-skilled workers. Among the options that have been explored as ways of preparing these students for middle-skill jobs are the following: cognitive apprenticeship, tech prep, integrated vocational and academic education, career magnet schools and academies, work-based youth apprenticeship, cooperative education, and school-based enterprise. The development and implementation of each option has varied widely. Seven criteria for assessing models for preparing noncollege-bound students for middle-skill jobs have been proposed. The first six focus on the nature of the learning arrangement, and the seventh addresses replication and diffusion of the arrangement. (The bibliography lists 81 references. A separately-published executive summary is appended.) (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 362 764

NCRVE

National Center for Research in
Vocational Education

University of California, Berkeley

BUILDING THE MIDDLE

[illegible]
[illegible]
[illegible]

BEST COPY AVAILABLE

CE 064 870

BUILDING THE MIDDLE

Sue E. Berryman
Erwin Flaxman
Morton Inger

Institute on Education and the Economy
Teachers College, Columbia University

National Center for Research in Vocational Education
University of California at Berkeley
1995 University Avenue, Suite 375
Berkeley, CA 94704

Supported by
The Office of Vocational and Adult Education,
U.S. Department of Education

December, 1992 MDS-408

FUNDING INFORMATION

Project Title:	National Center for Research in Vocational Education
Grant Number:	V051A80004-92A
Act under which Funds Administered:	Carl D. Perkins Vocational Education Act P. L. 98-524
Source of Grant:	Office of Vocational and Adult Education U.S. Department of Education Washington, DC 20202
Grantee:	The Regents of the University of California National Center for Research in Vocational Education 1995 University Avenue, Suite 375 Berkeley, CA 94704
Director:	Charles S. Benson
Percent of Total Grant Financed by Federal Money:	100%
Dollar Amount of Federal Funds for Grant:	$5,775,376
Disclaimer:	This publication was prepared pursuant to a grant with the Office of Vocational and Adult Education, U.S. Department of Education. Grantees undertaking such projects under government sponsorship are encouraged to express freely their judgement in professional and technical matters. Points of view of opinions do not, therefore, necessarily represent official U.S. Department of Education position or policy.
Discrimination:	Title VI of the Civil Rights Act of 1964 states: "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." Title IX of the Education Amendments of 1972 states: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance." Therefore, the National Center for Research in Vocational Education project, like every program or activity receiving financial assistance from the U.S. Department of Education, must be operated in compliance with these laws.

FOREWORD

This paper is an interpretive synthesis of the research of the National Center for Research on Vocational Education (NCRVE) on a series of educational reforms related to the preparation of youth for postsecondary training and work. Work preparation traditionally has been thought of as the venue of students not able to do rigorous academic work—those not bound for college—but we have learned that the cognitive principles of work-related education are the foundation for the learning necessary for both further academic education and success in a changing workplace at all job levels. We strongly feel that the nation needs to objectively examine the various proposals for work preparation, some already implemented, to build an educatively powerful training *system* for students, not just a patchwork of different programs, not one of which meets the basic criteria for positioning students for middle-skill jobs.

Although we most consistently highlight NCRVE research on the work preparation system, we do not in any way want to suggest that other research has not contributed to an understanding of the options for creating such a system. Our intention here is to present the NCRVE research as a coherent and unified body of knowledge that can contribute to the design of a national work preparation system. The readers of this synthesis should consider it in conjunction with the related work of other researchers.

CONTENTS

Foreword i
Introduction 1
Why the Sudden Interest in Building the Middle? 2
    Economic Factors 2
    A Shift in the Demand for Skill 4
    The Allocation of Educational Resources 8
Design Criteria for Building the Middle 10
Where Are We Now? Assessing the Options 18
    Cognitive Apprenticeship 20
    Tech Prep 29
    Integrated Vocational and Academic Education 37
    Vocational Education as Part of General Education 44
    Career Magnet Schools 47
    Academies 50
    Work-Based Youth Apprenticeship 54
    Cooperative Education 61
    School-Based Enterprise 68
Where Do We Go From Here? 69
References 77

INTRODUCTION

The problem is simple to define and hard to solve. The problem has two pieces. One is that the American economy no longer rewards little skill with middle-level wages. The other is that, as Europeans have observed, the U.S. education and training system is "missing the middle." It has no coherent educational strategy for the many young people who now complete high school equipped neither to complete college nor for the training required to enter middle-level jobs.

The solution, "building the middle," means taking seriously the education of our nation's students, especially the nonbaccalaureate-bound. Thus, we are talking about redesigning a K-12/postsecondary system that now takes seriously the education of only the top ten or twenty percent of each youth cohort. The solution implicates not just schools, but also employers. It requires knitting together the demand and supply sides of the equation.

This document, based on the work of the National Center for Research in Vocational Education (NCRVE), examines options for solving this problem. Although the nation is in its infancy in thinking about and starting to build the middle, we already face a bewildering array of options and models. Multiple ideas are productive if we learn from them by rigorously comparing them to one another. In education, however, we have a penchant for multiplying ideas without investing the hard, sustained work required to weed through them and continuously improve the survivors. By contrast, the American health system, for all of its distribution and cost problems, shows a pattern of steadily replacing less effective or harmful procedures and medications with more effective ones.

Building the middle requires changing many pieces of the American education and training system—its curriculum; pedagogy; organization of time; assessment practices; technology; the skills and knowledge of its teachers; and the relationships among K-12, postsecondary education, and workplaces, and among academic teachers, vocational teachers, learners, and employers. It is as simple and as formidable as that.

Redesign of this magnitude cannot happen with a demonstration here and a network there or with the undisciplined and hapless proliferation of untested and unimproved ideas that usually passes for "change" in education. And it will not happen without a national infrastructure to support and discipline these ideas.

In this report, using the work carried out by NCRVE researchers, we (1) specify design criteria for building the middle, (2) clarify the similarities and differences among the ideas now being considered, (3) identify the defining characteristics of each, (4) discuss their strengths and weaknesses in meeting the design criteria, and (5) identify barriers to their adoption and diffusion.

WHY THE SUDDEN INTEREST IN BUILDING THE MIDDLE?

The realization that we have to seriously prepare all students emerged relatively suddenly in the 1980s. Several factors coalesced to create this perceptual shift: changes in wage patterns, especially for those without a college education; the employment and unemployment trends for those with various levels of education; trends in the relative growth rates of occupations using various average levels of education; research evidence on the skill implications of economic restructuring; and an understanding of how public education and training resources that develop human capital are now organized and allocated.

Economic Factors

Several economic studies show that wages for male noncollege graduates have been falling, in constant dollar terms, since the early 1970s, with serious consequences for family formation and maintenance.

The loudest alarm was sounded in *The Forgotten Half* (William T. Grant Foundation, 1988a, 1988b). This study, reporting wage trends by education for 20- to 24-year-old males from 1973 to 1986, revealed staggering wage losses for those with less education: During this period, mean annual earnings of male high school dropouts declined by forty-two percent. Other studies paint a similar picture. Kevin Murphy (personal communication, 1992), updating the analyses of Murphy and Welch (1988), found that for high school dropouts who were working full-time mean constant dollar weekly earnings in 1990 were the same as they were in 1963. The story for high school graduates is approximately the same: In 1990, their weekly earnings, in mean constant dollars, were five percent less than in 1963.

Analyzing several studies, Levy and Murnane (1992) report that between 1979 and 1987, the median real earnings of 25- to 34-year-old male high school graduates working full-time and year-round fell by twelve percent in constant dollars. This decline was accompanied by an eight percent increase in the median earnings of their male college graduate counterparts. In 1979, college graduates earned about thirteen percent more than comparable high school graduates; by 1987, the earnings differential between these two groups had risen to thirty-eight percent. For women in the same age group, the premium earned by college graduates working year-round rose from twenty-three percent in 1979 to forty-five percent in 1987.

Unemployment rates for male 25-64 year olds increased between 1970 and 1988 for all education groups, but much more for high school dropouts and graduates than for those with some college or college graduates.[1]

Labor force participation rates tell a similar tale. According to the U.S. Bureau of Labor Statistics (1989), labor force participation rates for 25- to 64-year-old males declined from 1970 to 1988. The rates declined for all education groups, but the decline was greatest for those with the least education. For example, in 1970, 10.7% of 25 to 64-year-old male high school dropouts were out of the labor force (defined as neither employed nor looking for work); by 1988, this percentage had increased to 23.6%. For college graduates, only 3.9% were out of the labor force in 1970; in 1988, the number had increased, but was still only 5.6%.

The joint effect of the increase in unemployment rates and decline in labor force participation rates for 25 to 64-year-old males with less education between 1970 and 1988 is sobering. In 1970, 14.3% of high school dropouts were either out of the labor force or unemployed. By 1988, this percent had increased by 118% to 31.2%, which translates into one out of every three being either out of the labor force or unemployed. In 1970, only 6% of high school graduates, or one out of every seventeen, were either out of the labor force or unemployed. By 1988, this percent had increased by 168% to 16.1%, translating into one out of every six being either out of the labor force or unemployed.

---

[1] The unemployment rate is the number of people employed divided by the number of people in the labor force. The labor force is the number of people working plus those not working but seeking work divided by the population. The employment rate is the number of people working divided by the number of people in the population.

Those with some college started the period with 6.8%, or one out of every fifteen, being either out of the labor force or unemployed. By 1988, this percent had increased by 81% to 12.3%, or one out of every eight being either out of the labor force or unemployed. College graduates had five percent, or one out of every twenty, out of the labor force or unemployed in 1970. By 1988, this percent had increased 42% to 7.1%, or one out of every fourteen being either out of the labor force or unemployed.

In sum, across time, the less educated were less apt to be employed, and when they worked, they averaged less income. The better educated were more apt to be employed, and college graduates showed wage gains.

A Shift in the Demand for Skill

Differences in skill, measured by differences in education, are increasingly *associated* with wage and employment differences across time. However, we cannot logically conclude from this relationship that increasing the skill of those increasingly disadvantaged in the labor market will affect that disadvantage. To make a judgment that supports an argument for building the middle, we have to look at what is happening to the demand for labor, particularly more skilled labor, independent of changes in the characteristics of the labor supply.

Levy and Murnane (1992) conclude that both changes in skill supply and skill demand account for the increasing returns for a college education during the 1980s. In this period, the rate of growth of college graduates as a percent of the labor force declined sharply relative to the 1970s, and analyses show that some share of the increasing returns for a college education is attributable to declining supply of college graduates. Increased rates of immigration of less-educated individuals increase the supply of less-educated workers, probably contributing to the decline in real median wages of high school graduates and dropouts. However, Levy and Murnane's analyses show that the supply factor cannot explain the entire wage gap and that there was a steady rise in the relative demand for more highly educated workers.

Grubb and Wilson (1992) provide a detailed analysis of the relative contributions of seven supply and demand factors to wage differences between groups during the period

1967-1988.[2] Although their analyses tell several stories, one is that differences in education contribute to inequality and, since 1979, contribute substantially to the increases in inequality. However, although racial and ethnic groups differ in mean earnings, non-white and non-Hispanic groups are too small to have much effect on overall wage inequality.

Levy and Murnane (1992) observe that the interaction of educational attainment, occupational structure, and sectoral composition of the workforce causes wage inequality. They point, for example, to a falling demand for blue-collar jobs, rather than for all manufacturing jobs. This interaction helps to clarify the concept of a declining middle class in that it reveals that it is increasingly hard for male high school graduates to earn a middle-class wage. In short, economic activity is changing in ways that make skill more valuable and the lack of skill more of a liability than ever before.

In sum, economic activity is changing in ways that make skill, as proxied by education, more valuable.

The skill requirements of our economy have changed in two ways: First, occupations that require higher-skilled workers are growing faster than occupations that can use lower-skilled workers. Bailey's analyses (1990; Berryman & Bailey, 1992) show that since 1975, higher-level occupations have grown almost two-and-a-half times as fast as lower-skill jobs. Although higher-skill jobs accounted for thirty-eight percent of total employment in 1990, they had grown sixty-five percent since 1975 and represented fifty-six percent of the total job growth in that time period. Second, the skills in many occupations have restructured: The job may go by the same name, but the skills needed for that job have changed.

This second source of change, skill changes *within* occupations, requires industry and firm case studies that take us inside the "black box" of the workplace. These studies need to be treated cautiously in that, like all case studies, their results cannot be generalized to any defined population of industries or firms.

---

[2] The supply or demographic variables were gender, age, education, race, and ethnicity; the labor market or demand variables; and industry of employment, occupation, and work pattern. The data is restricted to individuals 16 years or older with positive annual earnings and to wage and salary, not self-employment, income.

Recent research on the skill implications of work has reconceptualized the determinants of workplace skill requirements. It now understands these requirements as a function of the way that work is organized rather than simply of the technologies used. Clearly, technologies affect skill requirements, but not deterministically. Their effects appear to be mediated by the nature of the organization of work. Thus, the theoretical focus has shifted to the determinants of the choice of work organization.

In his analysis of industry case studies, Bailey (1992) observes that, although there are many possible ways to organize work, the current discussion can be understood in terms of two broad strategies. The traditional approach operates with unskilled or semiskilled workers; the innovative approach requires more highly skilled workers. The two types of work organization have several names: mass production versus flexible production (Piore & Sabel, 1984), command and control versus participatory (Hayes, Wheelright, & Clark, 1988), robust versus fragile (Thomas & Kochan, 1990), low performance versus high performance (Commission on the Skills of the American Workforce, 1990), and JAM (Job classifications, Adversarial relations, Minimal training) versus SET (Security, Employee involvement, and Training) (Brown, Reich, & Stern, 1991).

Traditionally, firms in the United States succeeded because of their ability to produce large quantities of standardized products, a strategy that depended on a mass production system with

> narrowly defined jobs that can be filled by interchangeable, low-skilled workers; large inventory buffers that minimize the disruption caused by production errors or poor quality parts; extra employees to cope with higher absenteeism; sophisticated quality control inspection and specialized personnel to catch defects after production is completed; and technologies designed . . . to control or limit worker discretion. (Thomas & Kochan, 1990, p. 28).

As Bailey (1992) points out, this system had many advantages. It reduced unit costs and training needs and insulated the firm's production process from turnover and absenteeism. But while the system allowed firms to operate with lower-skilled workers, this benefit was bought at a cost. Technology had to be specially designed to minimize worker control and limit worker discretion. It required high levels of inventory, sophisticated quality control systems, and specialized personnel. Front-line production workers were expected to be able to handle only routine problems, requiring many supervisors, managers, and support personnel to deal with any change in procedures or unexpected difficulties. In effect, employers made a tradeoff between low-skill levels and greater detailed planning, close supervision, and managerial effort.

The traditional system is most advantageous when products or services and production systems and technologies rarely change. When change is infrequent, the cost of the planning and development of specialized equipment and processes required to routinize tasks can be recouped over the long period in which tasks do not change. A stable environment also minimizes the number of unexpected problems that low-skilled workers would not be able to handle. If the use of a technology is limited to a small number of products or services, then the scope of routinization is much wider and skills can be significantly reduced.

The disadvantages of this system are becoming more apparent: Flexibility, fast response, and innovation have become the keys to growth and competitiveness, but these cannot be achieved with a low-skill, high-control system.

Rather than a low-skill, high-control system, the new economic environment requires the integration of traditionally separate functional roles (such as design, engineering, marketing, manufacturing, and so forth), flatter organizational hierarchies, decentralization of responsibility, and greater employee involvement at all levels (Dertouzos, Lester, & Solow, 1989; Hayes et al., 1988; Zuboff, 1988). Brown et al. (1991) observe that this restructured organization of work

> typically includes teams of employees who are cross-trained and rotate jobs, who engage in ongoing problem solving, who make and implement suggestions for long-term improvements, and who inspect their own work. The compensation system may include motivational rewards for company performance (profit-sharing), team performance, and skill acquisition (pay-for-skill). In unionized settings, the union and company have a cooperative relationship, and grievances are settled informally at the first level whenever possible. (p. 1)

Although the traditional systems have advantages in terms of control and reduced training and skill needs, the alternative system is more responsive and flexible and more conducive to continuous innovation. In effect, by making lower-level workers more flexible and skilled and by giving them more responsibility and discretion, their jobs incorporate some of the supervisory, planning, repair, maintenance, quality control, and support functions that were previously reserved for managers or specialists. This has the added advantage of saving time and eliciting positive participation from front-line workers for product and process development and innovation. This type of system is therefore based on much less direct supervision but requires workers with higher skills.

Charles Schultz has pointed out that education improves a worker's ability to deal with the change and uncertainty that seems increasingly characteristic of the U.S. economy (Levy & Murnane, 1992). Similarly, Levin (1987) saw that workers with higher educational levels are able to operate more effectively than those with less education in work settings with high levels of employee involvement.

The Allocation of Educational Resources

The case for building the middle depends not just on changes in the economy's need for skill, but also on patterns of how learning opportunities are allocated in this country. Who gets which of these opportunities? Are these opportunities coherently organized around a future objective such as college or workplace careers? To whom do the adult advisors in the educational system—particularly counselors—pay attention, and how do they pay attention?

Substantial literature bears on these questions. However, two studies directly relevant to building the middle—Little and Threatt (1992) and Selvin, Oakes, Hare, Ramsey, and Schoeff (1990)—pull together threads that weave through many of the other studies. These studies force us to ask why we should be surprised by the wage and employment declines for noncollege graduates, given the apparent increase in employers' demand for skill.

Selvin et al. (1990) found that counselor case loads at comprehensive schools are so heavy (350-700 students per counselor) that counselors respond either to those with severe behavioral and academic problems or to college-bound high-achievers who promised the most rewarding relationship. The rest of the students are largely on their own. Further, counselors view career and occupational guidance as secondary to academic guidance.

Their study also found that curricular patterns at these schools mirrored the guidance priorities: college-level preparation and basic skills remediation. There was no curricular structure oriented to preparing students for middle-skill jobs.

We would expect the vocational component of a high school to be a logical partner in building the middle. However, vocational education was nearly invisible in these schools. Academic graduation requirements had reduced vocational enrollments. These enrollment declines, the increased academic emphasis of the schools, and overall declines in funding had decimated vocational offerings: "As a result, none of the schools has a cohesive, sequenced vocational curriculum" (Selvin et al., 1990, p. 85). The vocational courses that remained reflected not a deliberate strategy, but the confluence of several factors: attempts to retain "traditional" vocational courses (e.g., sewing or auto shop), the relative seniority of individual vocational teachers, the attractiveness of particular courses to students, the school's and district's abilities to raise additional funds for vocational courses, and prevailing perceptions of the needs of students at each school.

The hodgepodge of vocational courses that remained at each school was of mixed quality. Although there were exceptional individual vocational teachers at each school, many of these schools' vocational offerings were staffed by "poor or unmotivated teachers, using outmoded equipment and teaching skills" (p. 85) no longer relevant in business or industrial settings. The vocational programs often became "holding pens" for disruptive or academically less able students.

Little and Threatt (1992) report similar findings at the comprehensive schools they studied. They found that the world of work was nearly absent from the curriculum. The value placed on the college-bound set the standard, marginalizing the noncollege-bound and their teachers and curricula. Even vocational courses had only the most tenuous connection to the world of work and served primarily as safety valves, absorbing increasing numbers of students designated as "remedial" or "at risk."

Oakes (1991) sees the values that led to this situation as formidable obstacles to building the middle. Educators consider students' abilities and aspirations to be "fixed" and unchangeable by the time they reach high school. The curriculum is split to *accommodate* students' various dispositions toward school work, not to *alter* them. The split curriculum is not equal; higher status and more resources go to the college prep program. Finally, placement of students into the academic, vocational, or general program is based, in part, on judgments about abilities of individuals by virtue of their membership in different racial, ethnic, and socioeconomic groups.

In sum, our education system is not allocating learning opportunities equally. Educational resources are devoted to the college-bound, and *non-educational* student support services are allocated to those with unusual behavioral or academic deficiencies. The rest of the students do not get their fair share of either educational resources or support services. And none of the students receives serious preparation for work.

Because most American high schools are not now organized to prepare nonbaccalaureate-bound students for middle-skill jobs, attempts to confront the missing middle have generated a flurry of learning arrangements and alternative approaches. We refer to these various efforts as options, and in the following sections, we examine the promise and status of these options. We begin by proposing design criteria for judging what the various learning arrangements have to offer.

DESIGN CRITERIA FOR BUILDING THE MIDDLE

Before we generate more options or start choosing among those already in practice, we need to be clear about what we want these solutions to accomplish. The overriding educational objective of building the middle is easily stated. It is to create learning arrangements that are so highly motivating and so effective that all students develop the knowledge and skills needed for at least middle-skill and middle-wage jobs.

The design criteria that we propose come from our growing belief, based on our immersion in the many studies in this area, that these are essential elements. They represent our attempt to focus and structure the discussion, and we invite people in the field to critique and respond to them.

The first six criteria involve the learning arrangement. The seventh addresses replication and diffusion of the arrangement.

1. The option sets up educationally rich and problem-rich learning activities that reflect the knowledge demands of the work contexts in which knowledge and skill have to be used.

2. The option creates a "community of expert practice," where the adults do more than talk about the practices of that community and play the role of subject-matter coach during the learning process.
3. The option develops knowledge and skill efficiently.
4. The option engages employers in curricular design, the creation of work-experience positions, and commitments to hire the program's graduates.
5. The option makes the relationships and tradeoffs between different training investments transparent for students.
6. The option should be designed to prevent its being captured by the more advantaged or abandoned to the less advantaged.
7. The option can potentially scale up into a national system that prepares students for middle-skill and middle-wage jobs.

The option sets up educationally rich and problem-rich learning activities that reflect the knowledge demands of the work contexts in which knowledge and skill have to be used.

This criterion establishes two requirements for the learning situation. One is that the situation should mirror what people have to know and how they have to use what they know in the workplace. The other is that the learning activities must develop broadly applicable knowledge and skills.

Reflecting the Knowledge Needs of the Workplace

Schools routinely fail to reflect the knowledge and skills needed in the workplace or the contexts of their use, and this is true not only of K-12, but of professional schools as well (Berryman & Bailey, 1992; Raizen, 1989; Resnick, 1987). Resnick (1987) points to contrasts between in-school and out-of-school mental activity that raise fundamental questions about the utility and effectiveness of schooling as currently practiced for all nonschool activity, including work. The indictment applies more to academic than to vocational education.

- In school, a student's success is independent of what other students do; out of school, successful functioning depends on the mesh of several individuals' mental and physical performances.

- In school, the emphasis is on pure mental operations without the use of such tools as computers, dictionaries, and calculators (derisively called "crutches"). Yet out of school, most mental operations are involved with and shaped by the physical and intellectual tools available, and the criteria for competence includes the expert use of tools.

- School learning is mostly symbol-based; outside of school, actions are intimately connected with things and events, and mental activities make sense in terms of their immediate effects. Because it is detached from meaningful contexts, school learning tends to become a matter of learning rules and saying or writing things according to the rules, whether or not the student knows the reasons for the rules. Alfred North Whitehead (1929) described this as the problem of "inert knowledge": knowledge of principles without experience in understanding their implications for, and relevance to, specific situations.

Educationally Rich Learning Situations

Scribner and Sachs (1991) show that the key issue for learning is the same for schools and workplaces: Learning is enhanced or inhibited by the way the learning situation is structured. A company that organizes work or a school that organizes learning as a set of segmented tasks will limit what its workers or its students learn. Instead of developing a conceptual understanding, they will learn a highly routinized, inflexible set of responses. Companies with mass production organizations of work are more apt to structure learning as segmented tasks, as are schools that provide remedial education for less advantaged students.

Similarly, a company that organizes work or a school that organizes learning around situation-specific knowledge will limit what its workers or students learn. Although learning general principles without working with them in specific situations creates inert knowledge, situation-specific learning by itself is very limiting (Resnick, 1987). Academic education is most vulnerable to the former problem, and vocational education to the latter.

Integrating vocational and academic education can deal with both inert knowledge and narrow, situation-specific knowledge. The logic of a work-preparation system for late adolescents requires an emphasis on broad conceptual, social, and problem-solving skills in the context of occupational clusters, not narrowly defined occupations (Bailey & Merritt, 1992).

The option creates a "community of expert practice," where the adults do more than talk about the practices of that community and where they play the role of subject-matter coach during the learning process.

An approach that takes a significant step toward eliminating the division between the in-school and out-of-school worlds is what Schoenfeld (1988) calls "creating a community of expert practice." Well-designed apprenticeship situations create such communities, and Schoenfeld shows that they can be created in schools and for academic as well as vocational subjects. As a mathematics teacher, Schoenfeld tries to create what he calls a "*microcosm of mathematical practice*." He says,

> [T]he courses are a partially managed environment: I have a sense of what I want to achieve in them and of what problems will serve as fertile sources of ideas and explorations. . . . It is essential for me to help the students find fertile grounds for mathematical exploration. . . . But then it is equally essential for me gradually to remove myself from the process, moving to the side and prompting the group to resolve issues by itself. I remain engaged as a member of the community, making sure that the appropriate mathematical values are respected (Are we really sure? Is there a counterexample?). I refrain, however, from pronouncing what is right and what is wrong; I pose the issues and leave it (for as long as possible) for the class to resolve them. . . . At their own level the students are mathematicians, engaged in the practice of mathematical sense-making. They do mathematics, with the same sense of engagement and involvement. The difference is that boundaries of understanding that they challenge are the boundaries of their own understanding, rather than those of the mathematical community at large. (pp. 12-13)

Stasz, McArthur, Lewis, and Ramsey (1990) conducted an intensive case study of a high school interior design class taught by a working professional in the field. The class was project-based; students learned by doing design projects that lasted about six weeks and for which they had fundamental responsibility. The relationship between teacher and students was that of master and apprentice rather than either a collegial or didactic one. The teacher ensured that the values appropriate to professional interior design were respected and that the challenges and constraints that prevail in this professional community were represented in the learning situation. Although she gave some lectures and demonstrations, they were keyed to problems that were arising in the students' projects. This practice echoes Schoenfeld's (1988) observation that professionals in a field review knowledge, seek out facts, or do exercises only as they need them to pursue their practice of mathematics.

Both the mathematics and interior design cases reveal the nature of the teacher's and the learner's roles in this type of learning situation. The teacher, an expert at his or her craft, coaches, provides support, and gradually hands over responsibility for learning to the learner. Although learners start with simple operations, they do so in the context of being able to observe the master's execution of more complex skills. They also learn by struggling directly with relatively undefined problems, often in team situations.

The option develops knowledge and skill efficiently.

Efficiency is an issue for a given unit of learning and for a learning sequence. Holding length of time constant, a learning unit is more efficient than alternatives if the learner learns more in that unit.

A learning sequence is more efficient if courses are coordinated (articulated) with each other across the K-12 grades, between secondary and postsecondary systems, and within the postsecondary system. The lack of articulation between secondary and postsecondary technical courses is well-documented. The lack of articulation *within* the postsecondary system is less well-known but equally inefficient. For example, in New York State, the courses required to obtain an associate's degree as a physical therapist assistant cannot be applied to obtaining a bachelor's degree as a physical therapist. Physical therapist assistants who want to become physical therapists have to start from scratch (Stephen Hamilton, personal communication, July 15, 1992).

The option engages employers in curricular design, the creation of work-experience positions, and commitments to hire the program's graduates.

Building the middle requires an active relationship between schools and employers. Employers can advise educators on school-based, work-oriented curricula; provide work-based learning opportunities; and hire graduates. However, whenever an option involves employers, it has to confront the question of the types of workplaces and employers that it selects to work with. As noted earlier, workplaces can be divided into two major types: flexibly organized or routinized. Depending on their type of workplace, employers will differ in their curricular advice to educators and in the educational richness that placements within them offer, whether for training or employment purposes.

Curricular Design

If learning situations are to induct learners into communities of expert practice, whether in mathematics or radiology, they need to reflect the expert practice in these communities. School-employer relationships increase the chances that the learning situation can be updated to reflect current technology, modern work practices, and the knowledge needed to make a range of judgments and decisions in that community.

We think that the basic job of keeping school-based curricula current has to be done at national levels through national infrastructures. However, educators in local communities also need a context for understanding and implementing these changes in their classrooms. While their relationships to local employers can provide this knowledge, educators need to be careful in how they use employers as knowledge sources. Although there are many mismatches between employers' skill needs and curriculum and instruction in schools, employers are not usually good information sources about their needs.

Economic studies of restructuring companies find substantial variation *within the same company* in response to questions about what skills the company needs (Thomas Bailey, personal communication, July 16, 1992), the variation depending on the respondent's position in the company. Studies of on-the-job training find that employers often do not recognize the cognitive complexity of their own jobs, especially when these jobs are perceived as "low skill." Employers also "lag" the skill implications of restructuring their own workplaces—for example, they introduce just-in-time inventory arrangements but do not appreciate how these changes increase the skill requirements of jobs such as stockroom clerk (Scribner & Sachs, 1990).

Thus, educators have to develop relationships with employers that allow them to observe workplaces where they can use their educational experience to translate what they see into curricular and pedagogic ideas.

Work-Experience Slots

Quality work-experience slots are important for extending school-based learning, since even classroom-based simulations of real-world situations cannot entirely replicate the incentives and demands of those situations. They also ease students' labor market entry. In a work situation, employers obtain better, less biased information about the student than they can obtain in routine hiring interviews. Students also acquire firm-specific knowledge and skills valued by the employer. Grubb (1992) found that much of the economic payoff from two-year college degrees derives from this improved access to employment.

Commitments to Hire

Building the middle involves massive changes in the organization of learning and in students' investments in their learning, but they and their teachers need to know whether employers will respond to these changes with jobs and wages that reflect the added investment. Employer commitments may be contingent on the development of a stringent, preferably national, credentialling system. However, even with such a system, the option has to have the capacity to obtain employers' willingness to use it or other markers of added skill in their hiring and wage decisions. Local school-employer relationships provide the foundation to build these kinds of employer commitments.

The option makes the relationships and tradeoffs among various training investments transparent for students.

This design criterion is about information, but of different kinds. One kind is "truth in advertising." Is the option designed to inform potential investors (students) about the payoffs to training in a particular occupation and to training in that occupation from a particular program? In other words, is it designed to convey to potential students the wages and employment trends in particular occupations? Does it generate data on the quality of particular programs?

A second kind of information is about the relationships between occupations. Is the option designed to make transparent the career paths within a family of occupations such as the health occupations or occupations within the fashion industry? Options that organize their programs around individual occupations are not structured to convey information about career paths among occupations. Ones organized around a family of occupations, whether specific to an industry or common to many industries, help customers create a conceptual model or cognitive map of the career paths among these occupations.

Conveying career paths is relevant to the design of any credentialling system for a "built middle." For example, Singapore has set up a well-defined career ladder of certificates that span the range from tradesmen, who earn national trade certificates or other certificates in commerce and basic vocational training, to professionals, who possess university degrees. The United Kingdom works with five skill levels that span a similar range, from "preliminary" to professional. In contrast to these countries, New York State's Task Force on Career Pathways for Youth has just recommended a non-baccalaureate system of professional and technical certificates, a credentialling system that works with truncated career pathways and thus does not lay out how far individuals might go and what they need to know to get there.

The option should be designed to prevent its being captured by the more advantaged or abandoned to the less advantaged.

Any system organized around training for middle-skill jobs must be visibly connected to postsecondary education. Parents understand that college and the high school academic track that leads to it form the only path that gives their children a chance for an economically viable future. In the absence of a national system organized around preparing students for middle/higher-skill jobs, anything other than the academic track and college amounts to no preparation, which at best translates into low-skill jobs.

As a result, parents resist any reform that sounds as though it might preclude college for their children. They have been willing to settle for the "general" track, a virtual wasteland, because it purports to give weaker students "academic" training. The words "vocational," "workplace," or "applied" are all heard as warning bells.

However, a system attractive to more advantaged families runs the risk of being "captured" by them, something that has happened to career magnet schools in some cities. One way to deal with the problem is to increase the number of such schools—in other words, reduce their scarcity. This strategy has just been proposed in New York City, where all comprehensive high schools would convert to career magnets. Another is to move to New York City's current approach, which is to require each career magnet to accept a specified proportion of students from each of three levels of reading achievement.

Even a well-designed built-middle will still have some tracking properties. Although some students will proceed to the baccalaureate, not many will aspire to the baccalaureate early in their educational careers. However, if well-designed, the option will eliminate the most egregious elements of tracking in that it will take seriously the coherent preparation of a much larger share of youth.

The option can potentially scale up into a national system that prepares students for middle skill and wage jobs

To be able to "grow" a national system, an option has to be able to replicate with quality and to diffuse broadly. In evaluating options on this dimension, it is important to distinguish between obstacles to diffusion within the larger educational system and obstacles inherent to the option. An option can have inherent characteristics that can be expected to impede or enhance its diffusion. *Our concern is with this type of characteristic.*

All options face the daunting prospect that our education system does not invent, test, improve, and adopt innovations effectively. No matter how good they are, the experience of decades is that innovations in one or a small number of schools do not diffuse to the rest of the 110,000 schools. Schools change all the time, responding to frequent (and often conflicting) constituent pressures to do or to desist from doing something. From this perspective, schools are permeable and innovative. However, these changes are ephemeral; they enter and exit the education system without altering its fundamental structure and with little impact on daily practice.

Although options differ in the extent to which they have to tangle with the educational system, the solution to the system's diffusion problems must be found at the level of the system itself, not at the level of individual innovations.

WHERE ARE WE NOW? ASSESSING THE OPTIONS

Where are we in solving the problems of building the middle? Not very far, but much further than we were even five years ago. The country already has several ideas that are relevant to building the middle. These include Tech Prep (or "2+2"), work-based apprenticeship, cognitive apprenticeship, integrated vocational and academic education, vocational education as general education, career magnet schools, academies, cooperative education, and school-based enterprise. We do not address stand-alone vocational schools because most of these have had limited success in broadening their student base and in dissolving the division between vocational and academic learning. Those that have successfully integrated vocational and academic learning and expanded their student base look like career academy programs or career magnets, whatever their formal names, and are treated under those categories.

In this section we describe the defining elements and the state of development and implementation of each option. How developed or embryonic is the design of each solution? How clearly are its elements specified?

What is the implementation status of each option? It is important to distinguish two kinds of implementation: (1) conscious implementation of the full-blown model and (2) ad hoc implementation of pieces of the model. The model is the motive force in the first case but not in the second. The first case includes all or most of the model's key elements; the second, only some of its elements. Whether the implementation is full-blown or ad hoc, there is the incidence issue. Is the model rarely or frequently implemented? Whether the model is rarely or frequently implemented, there is also the issue of its implementation pattern: "shallow" or intensive? In the shallow case, the model appears in schools, but as isolated activities within these schools. In the intensive case, it organizes the learning of the whole school (or school-within-a-school).

A thorough evaluation of any option should include data on any of the following types of outcomes that one might plausibly expect a work-preparation system to affect: skills and knowledge (foundation, generic workplace, or occupationally specific[3]), workplace-relevant attitudes, occupational identity and knowledge, program completion, school attendance, educational attainment, and labor market outcomes.

For the most part, this data does not exist. As the reader will see, several options are barely implemented, if at all. And for those that have been implemented, there is a lack of rigorous assessment of the outcomes. As we achieve stable representations of the different options, we must begin measuring their effects on selected outcomes, preferably in the context of random assignment experiments.

---

[3] We can divide the world of work-relevant knowledge and skills into four kinds. One kind is *foundation knowledge and skills*. These include the "tool" skills such as reading, writing, mathematics, speaking, listening, and the higher-order cognitive skills, as well as knowledge of subjects such as science. A second kind is the generic workplace skills that seem to be important across occupations and industries. The recent U.S. Labor Secretary's Commission on Achieving Necessary Skills (SCANS) identified candidate generic workplace competencies of working with resources, people, information, systems, and technology. For example, "interpersonal" was defined to include "participates in a team, teaches others new skills, serves customers, exercises leadership, negotiates, and works with diversity." Industry- or occupationally specific knowledge and skills, such as the skills needed to be a radiological technician or a bookkeeper, are the third type of skill. The fourth kind is *firm-specific knowledge and skills* such as knowledge of the bookkeeping system used in a particular company. This last type is not the responsibility of publicly funded education and training programs.

Although we discuss each option separately, the options are not mutually exclusive; elements from them can be and often are combined. In many cases, the variations from option to option are differences in emphasis. For example, cognitive apprenticeship is not an organizational option; it is a learning paradigm, a curricular and instructional strategy that can be used as part of any organizational option. Nonetheless, we discuss each option separately to enable the reader to understand what each has to offer. The objective is not to select a winner from among the options but to provide a template for building a strong school-to-work transition program emphasizing the most valuable components from each of the different approaches.

Cognitive Apprenticeship

Defining Characteristics

This option, a modification of traditional apprenticeship, flows from a theory of learning based on cognitive science about how people learn most effectively and naturally. Although Collins, Brown, and Newman (1989) outlined its specifics and named it, their work builds on a century of thought, research, and experience: nineteenth and twentieth century educational thinkers such as Parker and Dewey; analyses of the spectacular learning of young children; analyses of traditional apprenticeship systems; reflections about what happens when cognitive scientists, as teachers themselves, try to create different learning situations; and cognitive science research itself.

Traditional apprenticeship was developed in traditional occupations such as tailoring or weaving which are visually observable to the novice and for which embodied knowledge—the knowledge of the hand—is important. Visually observable or "externalized" skills make them available to students and teachers for "observation, comment, refinement, and correction." Traditional apprenticeship also presumes relative constancy in the activities being learned and does not focus on developing the skills and knowledge that seem needed when domains are characterized by change and nonroutine events. Tailors, midwives, or rugmakers encounter nonroutine events, but the incidence of these events is low relative to modern work.

Cognitive apprenticeship takes account of the fact that many modern occupations—whether machine repair,[4] management, mathematics, law, or computer-based machining—have important cognitive components. Since cognitive components of an activity are ordinarily not visible, cognitive apprenticeship finds ways—for learning purposes—to "externalize" processes that are usually carried out internally. The greater volatility of modern work increases the importance of two types of skills that cognitive apprenticeship emphasizes. One is higher-order cognitive skills such as problem-defining, problem-solving, and knowing how to learn. The other is understanding and commanding the principles that help a person respond intelligently to unexpected events.

Collins et al. (1989) proposed a model that organized the elements of cognitive apprenticeship into four blocks: content, methods, sequencing, and sociology. *Content* includes the conceptual, factual, and procedural knowledge specific to a domain, a "domain" simply referring to subjects such as Russian literature, photography, structural engineering, cooking, economics, dancing, or statistics. The content also includes strategies for effectively using and expanding one's grasp of the particular knowledge and procedures of the domain. These strategies correspond roughly to higher-order thinking skills such as cognitive management ("metacognitive") strategies that govern the process of carrying out a task (goal setting, strategic planning, progress monitoring, plan evaluation, and plan revision). The cognitive strategies are to be taught in the context of, not separately from, particular content.

The *methods* block defines teaching methods that encourage student exploration and independence. These methods give students the chance to observe, engage in, invent or discover expert strategies in context. Its elements include

1. modeling, where the teacher, as expert, performs tasks so that the students can observe and build a conceptual model of the processes that are required to accomplish them;

---

[4] For example, in the textile industry, when textile machines were mechanically based, workers could see how they operated. Working around them gave operators a sense of how to repair them, and the additional training needed to become a "fixer" was acquired on the job with little or no formal instruction. This situation has now changed. Most machines now have microprocessors and other electronic components. Since important machine components are not visually observable, operating the machines does not provide much of a sense of what it takes to repair and maintain them. Now, to understand, diagnose, and fix the new machines, technicians have to be able to represent their structures and processes symbolically in their heads. To do this, they have to be able to follow complicated manuals, diagrams, and updates provided by the manufacturers (Bailey, 1988).

2. coaching, where the teacher observes students as they carry out a task and offers feedback, modeling, hints, reminders, and new tasks to bring their performances closer to expert performance;

3. scaffolding, which refers to supports that the teacher provides to help the student carry out the task, ranging from suggestions or help to actual physical supports such as the short skis used to teach downhill-skiing;

4. fading, where the teacher gradually removes supports until students are on their own, a process critical to autonomous and independent functioning;

5. articulation, which is any method to get students to articulate their knowledge, reasoning, or problem-solving processes in a domain, making visible otherwise invisible cognitive processes and making explicit assumptions that students bring to the learning situation;

6. reflection, which is any technique that lets students compare their own problem-solving processes with those of an expert, another student, and, ultimately, an internal cognitive model of expertise; and

7. exploration, which is any device that leads students into solving problems on their own and provides opportunities for experiential feedback so key to learning.

The third building block focuses on the *sequencing* of learning. It has strategies for deepening knowledge—increasing the student's expertise—and for broadening knowledge—understanding more about where and how the knowledge and skills can be appropriately used. It specifies how to find ways to let the student "see" the whole before trying to develop subskills. For example, watching an expert tailor construct a garment gives students a picture or map of their ultimate goal. They can then use that map as an "organizer" for their attempts to acquire the subskills involved in the expert performance.

The final block is called the *sociology* of the learning situation. "Sociology" means reproducing in the learning situation the characteristics of the real world situations in which what is being learned will be used. These include the technology, social relationships, incentives, and time frames that govern the accomplishment of tasks in the real world. Thus, learning occurs in contexts that provide meaning and that reflect the situations of use.

As a paradigm of learning, cognitive apprenticeship is expected to fit both vocational and academic subjects. The term "cognitive" should not be read to mean "academic." The model ignores our usual distinctions between vocational and academic education; its objective is to initiate the novice into communities of expert practice, whether the practice is what the rest of us might call "academic"—for example, mathematics—or "vocational"—for example, interior design. The subtitle of the original Collins et al. (1989) paper on cognitive apprenticeship is revealing in this respect: "Teaching the Craft of Reading, Writing, and Mathematics." The subjects might be seen as "academic," but their practice is defined as a craft.

Development and Implementation Status

Theoretically and conceptually, cognitive apprenticeship is a well-developed option. Its elements are sufficiently specified to provide a grounded sense of what its implementation should look like. However, it has rarely been implemented as a full-blown model and then only in hothouse environments. Cognitive scientists have employed the ideas in their classes, including classes for less advantaged students (Collins, Hawkins, & Carver, n.d.), but not beyond.

However, features of cognitive apprenticeship have been implemented more extensively in ad hoc ways. Well-conducted school projects, including some school-based enterprise activities, inevitably create many of the defining conditions of cognitive apprenticeship (Stasz et al., 1990; Berryman & Bailey, 1992). For example, students at Conval High School in Peterborough, New Hampshire, built and raced a solar-powered car as an applied science project (National Council on Vocational Education, 1990). The project evidenced all four blocks of the cognitive apprenticeship model. As states or schools move from multiple-choice tests to authentic assessment, we also see changes in the direction of cognitive apprenticeship (Darling-Hammond & Ancess, in press; Hill & Larsen, 1992). For example, as the State of Vermont moves to portfolio assessment, their classrooms are looking more like Schoenfeld's.[5]

Outcomes

As is true of the other options, we have no experimental studies involving random assignment of students, no systematic tests of the relative importance of different program elements or of the effects on different student populations. The only data we have on cognitive apprenticeships comes from hothouse learning situations. For example, a strategy to increase students' reading comprehension, especially that of poor readers, embodies several features of cognitive apprenticeship (Palincsar & Brown, 1984; Collins, Brown & Holum, 1991). Use of the strategy, called "reciprocal reading," increased the reading comprehension of poor readers from fifteen to eighty-five percent accuracy after twenty training sessions. Six months later these readers were still at sixty percent, recovering to eighty-five percent with one session.

---

[5] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

Despite the lack of systematic evaluative data, this option has a strong theoretical base. We believe that, if well-implemented, cognitive apprenticeship could improve the learning of all youth and for all classes of knowledge and skill (foundation, generic workplace, and occupationally specific). If the learning situation itself is as inherently motivating as students in hothouse situations have found it, it should also increase students' attachment to school, as indicated by more days attended and more years of school completed.

Strengths and Weaknesses in Meeting the Design Criteria

Cognitive apprenticeship does well in (1) creating educationally rich learning situations that reflect the knowledge demands of work contexts in which the knowledge is to be used, (2) creating a community of expert practice, and (3) preventing capture of the option by advantaged students or abandonment to the less-advantaged. It has strengths, at least in individual units, in developing knowledge and skill efficiently. It has no relevant design elements pertaining to engaging employers in curricular design, the creation of work-experience positions, or commitments of employers to hire graduates. It has no relevant design elements to make the relationships and tradeoffs among various training investments transparent for students.[6]

Cognitive apprenticeship sets up educationally rich learning situations, both in terms of content and the learning process. It develops subject-specific conceptual, factual, and procedural knowledge; it also develops higher-order cognitive strategies that let the individual operate effectively in, on, and with this knowledge. It arranges the learning process to develop deeper and more disciplined learning that is better remembered and more appropriately used.

---

[6] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

Cognitive apprenticeship reflects the knowledge demands of *restructured* workplaces and the work contexts in which knowledge and skill have to be used. Its stress on cognitive strategies fits the cognitive skills that employers in restructured workplaces need in all employees, including those on the shop floor. Teachers in cognitive apprenticeships facilitate and guide student learning but "fade" as rapidly as possible to give students control over their own learning. This strategy mirrors the relationship between supervisors and the supervised in restructured workplaces. Thus, cooperative learning groups mirror the teams of restructured workplaces. Contextualizing what is being learned in ways that reflect the nature of real world tasks helps students understand the meaning and appropriate use of knowledge and skill for nonschool situations.

One of the core ideas of cognitive apprenticeship is the learning situation as a community of practice, an idea central to traditional apprenticeship but modified in this case to fit the changed skill demands of modern activities.

Cognitive apprenticeship has no design elements that we would expect to increase the efficiency of learning *sequences*. However, studies of cognitive apprenticeships consistently report that they are highly motivating, with students engaging in learning a high percentage of the time (e.g., Stasz et al., 1990). This property should translate into more learning within a given time frame.

Cognitive apprenticeship has special promise for integrating the vocational and academic tracks of the school, thus preventing its association with any one socioeconomic class. Cognitive apprenticeship is a model of instruction for all students, both the B.A.-bound and the non-B.A.-bound. Because cognitive apprenticeship integrates the dual principles of mind and matter, the theoretical and the applied, it shows what bridging the divide between head and hand looks like. Its principles systematically preserve the best of what today we call vocational and academic education and integrates them into a single model that can be used to teach almost any subject; the sole remaining difference between vocational and academic education is in the subject-specific content of what is being taught. Since cognitive apprenticeship is designed to create a well-prepared mind at ease with the demands of real world tasks and equipped to continue learning, it retains the option of postsecondary education for all students. Thus, it eliminates the historic K-12 conflict between workplace preparation and preparation for postsecondary education.

Although cognitive apprenticeships could be connected to employers, these relationships are not design elements. The option also has no design elements that would make the relationships and tradeoffs between different training investments transparent for students. At the same time, its design elements are not antithetical to showing these relationships and tradeoffs.

Barriers to Diffusion

Cognitive apprenticeship can be used either in schools or in workplaces. In *schools* the fundamental implementation problem is their receptiveness to and capacity to handle apprenticeship forms of learning. Analyses of traditional K-12 schooling (Berryman, 1991; Berryman & Bailey, 1992; Raizen, 1989) reveal that major changes will be required to replace traditional paradigms with cognitive apprenticeship. The changes include curricula, teachers' roles and knowledge, students' roles, assessment, and even the school's daily schedule.

Changing Teachers' Roles and Knowledge

In cognitive apprenticeship, the teacher is expected to move from what one teacher called being a "sage on the stage" to "guide on the side." He or she develops knowledge and skill in problem-rich contexts, using the technologies, collaborative teams, and incentives of real-world situations.

Although cognitive apprenticeship does not require the integration of vocational and academic education, teachers from the two tracks can better adjust to the demands of cognitive apprenticeship if they do so jointly. Good vocational education is more apt to set up apprenticeship-like learning situations. Good academic education is more apt to focus on higher-order cognitive thinking skills and on the principles behind specific situations. Collaboration between the two groups—in team teaching or joint design of programs and instructional materials—should be fruitful. However, as Little (1987) notes, "[teacher] collegiality is rare. Most teachers can point to a treasured colleague, but few work in schools where cooperative work is a condition of employment" (p. 506). Since teachers usually work out of sight and sound of colleagues, cooperative work among them is often less practiced than in other adult work settings.

Handling these changes capably depends on major investments in teacher retraining. Moving to the roles of expert performer and coach requires learning new pedagogic routines. Creating a community of expert practice where the expert (teacher) *performs* the tasks to be learned means that teachers need a performance-based, not just a verbally based, grasp of their subject matter. Even if vocational and academic teachers are teamed with one another in the classroom, each needs a grasp of the other's area of expertise to be able to reinforce and complement the partner. Academic teachers generally are not accustomed to engaging students in hands-on, applied activities. They usually know little about the larger world of work and are therefore hard pressed to help students make connections between theory and practice. Vocational teachers, on the other hand, may be unsure of their ability to teach academic theory and abstract principles. Most vocational teachers have had only minimal formal training in mathematics, the sciences, and other academic subjects.

Unfortunately, most teachers' colleges cannot support the kind of retraining that these changes would require. Cognitive apprenticeship ideas are as novel a practice in these colleges as it is in the typical secondary school.

Changing Student Roles

In cognitive apprenticeship, students are expected to assume more responsibility for their own learning, work in teams and with the resources normally available in nonschool settings, and use their knowledge, not just talk about it. Students develop tactics to cope with these new demands (Stasz et al., 1990). These include "offloading"—making an apparently random choice which they present to the teacher for approval. If she approves it, their problem is solved; if she does not, they work to get her to constrain the problem for them. In "bulldozing," students make "brute force" decisions simply to resolve the ambiguity of the choice situation. They do not submit the decision to the teacher for approval but simply incorporate it in the larger task.

Changing the School's Allocation of Time

The usually individualistic nature of teachers' work means that school schedules are not structured to support collaborative teamwork. To work together, teachers need time when they can routinely meet together. Dividing the instructional day into fifty-minute hours of largely unrelated instruction militates against creating projects that cut across and connect subject domains and that need longer blocks of time. The school day may also be too short to accommodate the instruction that is needed to help students meet traditional college entry requirements in addition to participating in the less-orthodox cognitive apprenticeship instruction. A number of integrated programs already in place have a longer-than-average school day.

Making these changes means a direct confrontation with the local master schedule. Changes in 50-minute instructional units may run afoul of state curriculum guidelines. Union rules may hamper the introduction of integrated instruction. Unions may oppose a longer day, and they almost certainly will demand cash payments for teacher planning and development time.

Developing New Curricula

Good curricula for cognitive apprenticeships barely exist. A few "applied academics" offerings are commercially available, but these represent only four or five courses, well short of the curricular range that the high schools need. Since cognitive apprenticeship is most effective when tailored to the strengths and interests of individual teachers and students, even when good materials exist, teachers are likely to need help with curricular modification.

Changing Assessment

Although the goal is to develop new student competencies, there are almost no tests to assess them (Darling-Hammond & Ancess, in press; Hill & Larsen, 1992). Multiple choice tests do not assess the ability to use knowledge. They do not adequately measure higher-order thinking skills or the capacity to define and act upon a meaningful, complex problem.

Changing Colleges' Credit for High School Work

College admissions officers generally refuse to give credit for "applied coursework" in secondary schools, although there are some notable exceptions. The problems that some graduates of high quality integrated instruction have in obtaining admission to better colleges jeopardizes parental support of such programs.

Implementing cognitive apprenticeships in *workplaces* may change the problems associated with implementing them in schools but will probably not reduce them. All options with work-based components (Tech Prep, work-based youth apprenticeship, cooperative education, career academies, and career magnets) place a high priority on using the workplace to provide a high quality learning experience for students. However, at this juncture, we are really just settling for the presumed benefits of "exposing" students to actual workplaces.

Tech Prep

Defining Characteristics

Tech Prep links ("articulates") vocational education in a secondary school (high school and even earlier) to technical education in a postsecondary institution (technical training institute or community college) and to the workplace. Articulation ensures that students can move from one level of instruction to another without a gap or overlap in what they are learning and enter the workplace to fill a job at their level of competence (McCormick, 1980). Although such articulated programs have existed in some form for the past sixty years, they are currently being developed specifically to educate and train youth for careers in highly technical occupations.

Tech Prep aligns vocational and academic coursework into a common core in the secondary school and a postsecondary institution. The coursework is organized to provide training in occupational clusters, not to provide training for a specific occupation, as is the case in traditional vocational education (Parnell, 1984). A carefully designed Tech Prep curriculum engages a high school student in a four-year (2+2) or six-year (4+2) plan to gain competencies (knowledge, skills, and values) required for technical careers. The coursework consists of applied academics, courses that incorporate applications and experienced-based knowledge into academic matter, and vocational courses. Completion of the Tech Prep program leads to an associate's degree or a two-year certificate, usually from a community college (Hull & Parnell, 1991).

The curriculum is designed in collaboration with the business community to keep it in line with the demands of the workplace, and there are work-experience opportunities at all stages of the program. In general, Tech Prep is viewed as the technical education alternative to the college preparatory program; it usually, but not exclusively, serves students who are placed in the general track, although it is meant for all students and represents a fundamental educational reform.

Title III, Special Programs, of the Carl D. Perkins Vocational and Applied Technology Act of 1990 delineates Tech Prep as a combined secondary and postsecondary program leading to an associate's degree or a two-year certificate but further specifies that the preparation should be for a career in at least one high-tech field: engineering; applied science; mechanical, industrial, or practical arts and trades; or agriculture, health, or business. It also specifies that the student develop competence in mathematics, science, and communications through a sequential course of study and that the program lead to placement in employment.

The U. S. Department of Education further specified some desirable components of Tech Prep projects receiving federal funds: that they (1) not only provide for gainful employment, but are also able to lead to a transfer to four-year baccalaureate programs; (2) are developed in consultation with business, industry, and labor unions; (3) provide guidance in career development; and (4) effectively address the particular interests of special needs students.

There are a variety of Tech Prep program models, and although no single program is yet viewed as the ideal, five general components constitute the foundation of the program (Dornsife, 1992):

1. *Planning and establishing local priorities.* Establishing a local philosophy within the context of federal and state definitions of Tech Prep is an essential component because of the need to articulate instruction in two institutions working in a consortium arrangement, often with a local business. The initiative for establishing the program often comes from teachers within the institution, but in the actual planning, there needs to be executive commitment and clear responsibilities for the program at each institution, trust-building between the two institutions to counter tendencies toward turf protection, and the articulation of modest achievable goals at first and an openness to change later (Mabry, 1988).

   This planning must result in a written articulation agreement, signed by an official from each institution, that lays out the terms and objectives of the program and that is often reviewed and renegotiated as the program is implemented.

2. *Information/marketing campaigns.* Initially, the purpose of these efforts is to promote student enrollment; later, they are used to inform the students and others about the relationship of the coursework in the program and particular technical career opportunities. The campaigns can be initiated and maintained by any actor in

the consortium or by an outside consultant, and they use various media, presentations, and events to promote the program.

3. *Curriculum development.* This can take several forms. At its simplest, it articulates courses already in existence. Because the course content and evaluation instruments already exist, high school and community college instructors can easily collaborate under these conditions. The secondary students, in turn, are more likely to have relevant coursework that will not be duplicated at the postsecondary institution. In school settings where there are institutional constraints for developing a Tech Prep program, this is a low-risk way of achieving some short-term gains, but because it leaves no room for long-term planning to accommodate institutional or occupational changes, it may be a limited form of curriculum articulation.

   A second approach is to modify existing courses and to articulate a sequence of secondary courses in one or more technical program areas. In this approach teachers collaborate more because they are modifying courses and are receiving more applicable training in current occupational areas. Students see the relationship between schooling and preparation for work and take courses that lead to an identifiable career path. However, this is a more costly approach to Tech Prep because it requires incentives such as released time and additional salaries for teacher collaboration; funds to update material in line with occupational changes; and often, outside consultants to refine course objectives.

   A third approach to developing a Tech Prep curriculum is to articulate new courses and course sequences and to develop a vocational and academic core curriculum to provide training for a particular career. In current Tech Prep programs this is almost synonymous with the integration of "applied academic courses" in vocational programs (commonly Principles of Technology, Applied Mathematics, and Applied Communications). But the overall curriculum can also include "Tech Prep track" and academic courses. All these courses can be linked in a sequence to provide the student with a clear educational plan for meeting his or her career objectives and sometimes to provide places where the student can exit from the Tech Prep program. Additionally in this approach, representatives of business and industry suggest changes in course materials to reflect changes in jobs. The coursework is linked to the curriculum in the postsecondary institution and reflects the changing labor needs of the economy. The drawback of this approach is that the applied academics courses at its core are often not considered adequate for academic credit and employers do not always find the technology principles course adequate preparation for advanced technology occupations.

4. *Career guidance.* Guidance services in Tech Prep are not remedial or reactive but function as an integral part of the education program. Career development activities designed by guidance counselors are structured into a logical sequence to support the Tech Prep curriculum and help students understand the relationship of school to work and the concept of job preparation. This offers an opportunity for counselors to provide information for program evaluation and improvement (e.g., reviews of career planning exercises). For this to occur, however, strong leadership and support for this new guidance function and guaranteed funding is required.

5. *Program improvement.* This is the evaluation component of Tech Prep. It is usually the responsibility of the community college because the secondary school does not have the financial and personnel resources to collect and maintain data on the students or others involved in the program. The data is collected to guide practitioners in making program changes or improvements and to make the program accountable to management and legislative authorities. The Perkins Act mandates the development of outcome indicators for Tech Prep programs (e.g., labor market, learning, and access indicators).

   There is currently very little evaluation information about the programs because most of them have been in operation for only a few years, and it will likely take from five to seven years before a comprehensive evaluation can be conducted. Although most postsecondary institutions collect data on the percentage of course enrollments, academic progress, and placement rates, very little data is collected about the context, planning, and implementation processes of Tech Prep programs.

Development and Implementation Status

The articulated programs with a long history in vocational education are the basis of current Tech Prep programs. The programs have spread nationally because of the need to reform general track education in the comprehensive high school, the awareness that many students leave both high school and community colleges without the requisite skills for the workplace, and the interests of regional development, often expressed in the threat of local businesses to leave the area unless the schools can produce employable students to work in more highly skilled work environments.

The specific impetus for the spread of Tech Prep has come from federal legislation linking the availability of funds for vocational education to the development and implementation of Tech Prep. However, this legislation does not empower or provide a role for the national government or the states to enforce minimum design standards for Tech Prep programs or provide assistance to the local districts in developing the programs. Under these conditions, the programs, although pervasive, may not meet minimum standards or fully implement the Tech Prep model.

Models for implementing Tech Prep programs are sophisticated enough and have demonstrated sufficient positive effects to be benchmarked and disseminated, although they are isolated cases and, in general, there is no body of evaluation to support any model of Tech Prep. Even many programs that appear exemplary lack a strategy for developing an integrated curriculum; their coursework is aligned sequentially but is not fully integrated in content at the level of the individual course. Curriculum development and program improvement are less developed components in Tech Prep programs than the creation of articulation agreements, marketing, or working with the business community.[7]

Outcomes

There is a strong belief, backed by local data, that participation in a Tech Prep program increases the likelihood that a student will enroll and complete a postsecondary program or find career-oriented employment, although this data has not been systematically collected and analyzed. However, we do not yet know about the effects of Tech Prep on employability because most Tech Prep programs are only in early implementation stages. Many people are calling for a national evaluation to determine, first, whether the programs are being implemented as mandated by Congress and, second, whether they produce the desired learning effects.

Strengths and Weaknesses in Meeting the Design Criteria

Tech Prep has no relevant design elements for creating educationally rich learning situations that reflect the knowledge demands of the work contexts in which knowledge is to be used or for creating a community of expert practice. However, Tech Prep lends itself to absorbing models that are strong in these criteria. Tech Prep does well in developing knowledge and skill efficiently. It moderately meets the criteria of engaging employers in curricular design, the creation of work-experience positions, and commitments to hire its graduates; it does have strong potential to satisfy this criterion. Tech Prep does well in making the relationships and tradeoffs among various training investments transparent for students. It does well in preventing capture by advantaged students or abandonment to the less-advantaged; however, it might be seen as a sub-B.A. option for the less-advantaged.[8]

---

[7] For comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

Tech Prep is the only option designed to ensure the efficiency of learning sequences and to direct and guide students along career paths. With a chance for advanced placement in a community college, students are motivated to enroll in articulated classes in secondary school, and they are more likely to stay in postsecondary institutions because they have the opportunity to develop a range of workplace competencies. The effectiveness of the programs can make the graduates appear more desirable to local employers (Dornsife, 1992; Hayward, Bragg, Dornsife, & Hoerner, 1992).

Designed as the vocational equivalent of college prep, Tech Prep has the potential to provide educationally rich learning to students not directly bound for a four-year higher education institution. Its potential will be realized only when the course content becomes fully vocationally and academically integrated and the instruction becomes less didactic and more activity-centered.

Barriers to Diffusion

Tech Prep has to overcome parents' fears that it is a vocational tracking strategy under a new name. Although the bulk of Tech Prep programs are still in the planning stage, some other pitfalls (described below) are already apparent (Dornsife, 1992).

A Contradictory Educational Reform

Tech Prep has been viewed by some state and local groups as a contradictory educational reform because it aims for broad reform but tries to do it exclusively with vocational education funds rather than general funds and leaves control of the reform in the hands of vocational educators. Tech Prep can easily be burdened with the responsibility to reform education in the comprehensive high school, particularly the education of students in the general track, but with limited funds to do so. Increasingly, some states (Indiana, South Carolina, Tennessee, and Wisconsin) are considering or actually legislating (e.g., Oregon) the elimination of the general track in favor of the Tech Prep track. The dilemma for the high school is whether to use Tech Prep funds to realign vocational and academic learning for all eligible students or to use them to keep the curriculum in line with current vocational approaches—in essence, to have both a Tech Prep track and a traditional vocational education track. In addition, there is always a tendency in local institutions to modify reform proposals to avoid making any changes; unless there is a national evaluation strategy, the Tech Prep model as conceived by Congress may never be implemented.

---

[8] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

Institutional Status Conflicts and Faculty Resistance

Because of their traditional independence, secondary schools and postsecondary institutions do not always communicate well, are reluctant to formalize agreements, and are not always fully committed to teaching articulated classes. The turf and status conflicts that cause these problems can be exacerbated when the articulation is mandated by the state with no commitment from local officials to implement it.

Faculty reluctance arises when teachers and counselors are not included in the planning process and not given enough time to adjust to the curricular or structural changes of Tech Prep programs (e.g., incorporating applied academics or establishing a core curriculum and course sequences). In addition, many practitioners resist change, especially if it threatens existing vocational programs, or if they are confronted by competing educational reform approaches and expectations.

Program Management

Policy and community support for articulated programs waxes and wanes. In general, interest in articulated programs increases when enrollments decline, when there are policy mandates for the programs, and when popular instructional approaches make articulation easier. Support for articulation declines when postsecondary institutions want to increase their academic prestige by articulation with four-year universities. Under these conditions, administrators have problems meeting Tech Prep's financial requirements such as compensating faculty for released time to develop curriculum and to attend meetings or compensating postsecondary schools for credit earned by students who complete articulated secondary coursework.

Currently, there is a considerable amount of support and pressure for schools to create articulated Tech Prep programs. Some schools, however, are developing narrowly conceived programs—for example, just for advanced placement or just for curriculum arrangements—and not implementing the complete Tech Prep model to prepare students to enter high-tech occupations.

Although employers, parents, and practitioners are all essential to Tech Prep's success, in the early stages of program development not all the stakeholders have always been involved. Whoever is responsible for the planning, the planning team needs to have the commitment of the leaders in the consortium and access to resources.

The process also needs to be guided by a shared vision of the goals and desired outcomes of Tech Prep. However, local consortia or their parent state agencies currently are not introducing process or evaluation systems into their planning. Nearly all states are allowing a great deal of flexibility in the planning and implementation of Tech Prep programs; they are providing technical assistance and documenting local efforts rather than defining goals or expected outcomes for the programs. The burden for creating a vision for the programs is left to the local educational agency. Although this removes some bureaucratic restraints, it could mean few changes from the traditional way that schools provide vocational and academic education.

Reaching Special Needs Students

The Tech Prep legislation links the program to the other provisions for services for special populations in the Perkins Act. The purpose is to provide more opportunities for education in postsecondary institutions like community colleges and technical training institutes to these students as alternatives to the proprietary institutions where they are overrepresented. Currently, however, they are not being accommodated in the programs because (1) many of them drop out before coming to high school or early in the high school years; (2) the programs have too few programmatic options for these students, particularly academically enriched academic subjects; and (3) the programs offer too few opportunities for career exploration to these students, who may have had too few personal, educational, and work experiences previously to take advantage of the incentives within the Tech Prep model. The burden of making these programs more responsive to the needs of special populations and coordinating Tech Prep with other programs and services for special needs students falls on the states in drawing up plans for receiving Perkins money (Grubb, 1991).

Integrated Vocational and Academic Education

Defining Characteristics

The integration of vocational and academic education is a core curriculum and instructional reform that requires organizational changes in the school. It constructs programs of sequential courses so that students can achieve both vocational and academic competencies. It is the curricular and pedagogical base for a large number of proposals and models for restructuring and reforming vocational education because it replaces job-specific instruction, which gives students limited employment opportunities, with contextualized knowledge, which provides students with a range of skills and knowledge required in the workplace. It improves the teaching of vocational and academic subjects by replacing didactic methods with activity- or problem-centered instruction. It also fosters teacher collaboration in curriculum planning and the coordination of instruction. Finally, it involves the business community in the program to help students develop the competencies needed in their future occupations (Bodilly, Stasz, & Ramsey, 1992).

Interest in the integration of vocational and academic learning is not new to education: It is rooted in John Dewey's call for a curriculum that eliminates the conflict between academic and practical education. In our own age, the revived interest in integrated education comes from a recognition that current curricular divisions into vocational and academic education do not provide students with the problem-solving and interactive learning skills required by both the economy and social life.

Integration has been piloted by the Southern Regional Educational Board (SREB) State Consortium, mostly in the South and in small comprehensive high schools. Today, the impetus for integration is the Carl D. Perkins Vocational and Applied Technology Act of 1990, which provides funds to state and localities to develop programs that bring about this reform. The current legislation directs a substantial amount of money to urban school districts. How the integration is achieved is left to the discretion of the states and localities.

Integration is viewed as a solution to a number of specific educational, social, and economic problems. Stasz (1992) summarizes the reasons for the wide support for integrating vocational and academic education across many organizational arrangements:

> Both vocational educators and the critics of vocational education see it as a way of improving the academic content of vocational courses and better preparing students to perform in a workplace with greater and more rapidly changing demands than was the case in the past when narrow vocational

> skills sufficed. Federal legislators view integrated education as a means of helping students develop the technological skills to function in a competitive world economy. Employers support integration because it can provide the problem-solving skills to insure that workers can function in the high performance workplace. School reformers consider the integration of academic and vocational education as a way of making academic learning more available and meaningful to all students, especially those who lack basic academic and higher order thinking skills. Cognitive scientists support the concept of integration as a program based on sound principles for learning abstract or theoretical concepts under contextualized or applied conditions. Social critics see integration as a strategy for social justice, a better distribution of educational resources for providing all youth the chance to secure an economic future. (pp. 2-3)

Curriculum and instruction in integrated programs contextualize learning: The student learns theory and applications simultaneously. The learning situation thus has the potential to offer the problem-solving and interactive learning that occur in the workplace.

As an instructional strategy, integration can put into place the elements of cognitive apprenticeship: learning through guided experience. Because content and practical applications are learned together, the student visualizes the learning—it becomes external where under other conditions it is just internalized. The learning then becomes available to the student for observation, comment, refinement, and correction. This ability to visualize a procedure, skill, or process helps the student build a conceptual model of what he or she is learning and to target a performance goal (Berryman & Bailey, 1992; Collins et al., 1989; Raizen, 1989).

Integration programs require changes at various structural levels (course, program, special project, school-within-the-school, and whole school), in patterns of teacher collaboration, and in the distribution of integrated education to different kinds of students. The direction and variety of integration programs—and the kinds of changes these require—can be seen in models listed by Grubb, Davis, Lum, Plihal, and Morgaine (1991) and Grubb and Stasz (1991).

Model 1: Incorporating More Academic Content in Vocational Courses

This narrow reform affects only vocational teachers and vocational students. Newly developed curriculum materials, sometimes developed externally, are used to introduce a wide range of academic and basic skills into vocational courses. The level of the materials is relatively low, and their purpose appears to be largely remedial. Sometimes they are linked to the goal of developing core competencies or proficiencies in vocational students. The advantage of this form of integration is that it does not require any new institutional arrangements; it can be done within existing vocational courses and does not require coordinating the work of groups of teachers.

Model 2: Combining Academic and Vocational Teachers To Incorporate Academic Competencies in Vocational Courses

Although this approach also affects only vocational students and vocational courses, vocational and academic teachers collaborate in developing the content of courses, and academic teachers sometimes teach the vocational courses. This team-teaching approach usually does not require any organizational changes: It works best in area vocational schools in self-contained vocational programs; it does, however, require allocating resources for academic teachers to work with vocational teachers.

The applications of models 1 and 2 do not truly integrate vocational and academic education; they merely provide remedial instruction in academic coursework to students in vocational education programs who may have failed to receive a proper academic education earlier in their schooling.

Model 3: Making the Academic Curriculum More Vocationally Relevant

This model changes only the academic program, introducing vocational applications into it. This is most commonly done through specifically constructed "applied academic" courses—for example, Principles of Technology, Applied Math, and Applied Technology. Potentially, all students could take the courses; but in practice, they are taken by students in the vocational and general tracks and are used as remedial courses. However, they are considered superior to conventional remedial courses because they teach concrete subjects.

This approach and the infusion of basic skills instruction in vocational courses are the most common current forms of integrating vocational and academic education. This approach to integration does not require any significant organizational changes or curricular reform; because the schools use prepackaged courses, vocational and academic teachers need not collaborate in developing coursework. It requires no new resources for staff training or released time for collaborative curricular development.

Model 4: Modifying Both Vocational and Academic Curricula and Curricular Alignment

In this model, both vocational and academic coursework are changed. In what could be called "horizontal curricular alignment," vocationally oriented material is introduced into academic courses and academically relevant material is introduced into vocational courses.[9] In this curriculum change, vocational and academic teachers collaborate to modify their courses, and the changes occur across courses at the same time. The scope of collaborative planning can vary according to inclinations of the teachers and the mix of resources, but collaborative planning is an essential element of this model. Unlike other integration models, this one has the potential to affect all students in the school.

Model 5: The Academy Model

This approach uses "academies"—schools-within-schools—as organizational structures for integrating vocational and academic education. A group of teachers collaborates in developing a vocational and academic curriculum for a cluster of students whom they work with over a period of years. Because each academy is organized around a specific occupation, it is possible to integrate vocationally relevant material into academic courses. The academy structure also changes the organization of schooling in ways that other models do not: Teachers are given more time to plan and collaborate; students follow a block of courses and are taught in smaller classes; and schools form relationships with employers in industries related to the school's occupational focus, where the students often receive work experience.

For the most part, however, academies are designed to educate potential dropouts who are tracked into these special programs; they are not designed for school-wide educational reform or restructuring, and because they segregate students into these special programs, the integration of the coursework does not "detrack" the classrooms in the academy.

Model 6: Single-Occupation Vocational Schools

In these schools, the integration of vocational and academic education is school-wide, potentially in all courses. Because all academic teachers in these schools are preparing students to follow a particular career or to work in a particular industry, resources for aligning the academic curriculum with the school's occupational focus are readily at hand, and the culture of the school supports their use. This is most apparent in the large amount of collaboration between vocational and academic teachers that is required in these schools. Occupationally focused schools also "detrack" students because there is no distinction between vocational and academic students. Organizationally, they constitute a self-contained independent structure; they also function as career magnet schools, which tend to break down the academic isolation of socially and racially segregated neighborhood schools.

---

[9] Horizontal alignment integrates vocational and academic material at the course level; in vertical alignment, a sequence of courses integrates vocational and academic material into a whole program.

Model 7: Replacing Departments with Occupational Clusters

In this approach, vocational departments (business, agriculture, and industrial arts) and academic departments (English, mathematics, social studies) are replaced by departments organized by occupations. This aligns and creates a coherent sequence of courses, and because teachers belong to a cluster as well as a vocational or academic department, they collaborate more with one another in developing curriculum and teaching than is the case in the other models. Also, because the program is open to all students, it integrates the traditionally segregated vocational and academic student groups. Structurally, this model resembles a school-wide academy.

Model 8: Combining Departments and Occupational Clusters

This approach creates an organizational matrix: It establishes occupational clusters that cut across the traditional departments, but it retains the department structure. Students follow a career path that incorporates solid academic coursework and sophisticated vocational courses. Formally, it is a program integration strategy rather than a strategy to integrate vocational and academic curriculum material in courses or sequences of courses; informally, however, vocational teachers are encouraged to infuse academic material in their courses, and academic teachers are encouraged to find vocational applications in theirs. Also, because the career path program is open to all students, vocational and academic students and teachers are on an equal footing; students and teachers belong to both a department and a specific career path. Finally, schools organizing courses by career paths, like other arrangements with an occupational focus, link schooling with local industry. Before entering a career path program, students are provided with counseling about their program and opportunities to gain meaningful work experience.

Development and Implementation Status

Integration programs are distributed widely in various organizational arrangements, within separate vocational and academic education programs, across programs in vertical and horizontal clusters, in schools-within-schools, and in separate magnet schools. The structures for delivering integrated vocational and academic education are more developed than the curriculum and pedagogy in most places. The state-of-the-art in integrated curriculum materials is primitive (and controversial), and although teacher collaboration is the bedrock of integration, teachers have not developed a tradition of collaboration and joint action, and schools have not yet provided the policies, resources, and incentives to encourage and support collaboration.[10]

Outcomes

To date, there have been no systematic evaluations of the learning outcomes of integration programs. Many have never been fully implemented. What is more, since integration takes many forms, it will be necessary to determine the differential impact of each model on learning outcomes before we can see the overall effect of integration programs.

Strengths and Weaknesses in Meeting the Design Criteria

Integration does well in creating educationally rich learning situations that reflect the knowledge demands of work contexts in which the knowledge is to be used and in creating a community of expert practice. It does well in developing knowledge and skill efficiently—particularly in individual units, but less so in sequences. It is weak in engaging employers in curricular design, the creation of work-experience positions, and commitments to hire its graduates. Integration has no relevant design elements for making the relationships and tradeoffs of various training investments transparent to students. It does well in preventing capture by advantaged students or abandonment to the less-advantaged.[11]

Integrated programs can put into practice the principles of cognitive apprenticeship and therefore can provide educationally rich, problem-centered learning (Berryman & Bailey, 1992). However, integration can occur at a number of levels of thoroughness, not all of which offer educationally rich learning. For example, integration can devolve into simply infusing the academic curriculum with some vocational perspectives or upgrading vocational programs. Learning in integrated programs is activity-centered, not didactic; but currently, interest in establishing curricula for integration programs far exceeds interest in designing the pedagogy.

---

[10] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

[11] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

Integrated programs create apprenticeship opportunities for students, and employers provide work-experience positions. Because of this link to the business community, integrated programs provide information about a variety of occupations and career paths. Because they are not articulated with other institutions or credentialling agencies, however, they do not necessarily put a student on a career path.

Integrated programs are specifically designed to end the stratification of schooling that distinguishes between more-advantaged students who receive educationally rich instruction and less-advantaged students who receive basic, remedial, or a generally watered-down education. Tracking is eliminated; instruction is not remedial; and student-driven projects and problem-centered curriculum and instruction replace teacher-driven basic skill instruction. Moreover, students in integrated programs are guided in planning their program, not just counseled in moments of crisis. Thus, in integrated programs, students are better able to plan for a continuous educational program leading to the acquisition of the skills and knowledge needed for increasingly higher-skill jobs.

Barriers to Diffusion

The Two Worlds of Vocational and Academic Education

Vocational and academic education constitute two separate cultures in most high schools—with separate curricula, teacher preparation and credentialling, and students served. Most educational reforms preserve this separation. Indeed, the image of vocational education as a "dumping ground" for poorly prepared or intellectually inferior students in need of some occupational preparation is used to justify this separation (Stasz, 1992, pp. 8-9). Integration programs will thus be difficult to implement because schools are likely to resist reorganizing into academies, career magnets, and the vocational course clustering that is necessary for integration (Stasz, 1992).

State Policies

State policies for graduation requirements, curriculum, teacher credentialling, and scheduling and instructional time can inhibit the implementation of integration programs (Stasz, 1992).

Local Capacity

A school's prior experiences with innovation, the stability of its administration, and its capacity to be flexible in scheduling teachers and students are all factors in implementing an integration program. The implementation is also affected by the strength of a school's financial base and the capacity of local leadership to sustain the program in the face of competition for scarce resources (Stasz, 1992).

Planning and Support

Without long-term planning and a shared vision, integration will not be adopted. Long-term planning gives teachers a chance to adjust or make changes (e.g., for retirement or recertification). Lack of funds for teacher retraining and curriculum development and lack of time for joint planning are also barriers. Finally, teachers will resist implementing programs if they perceive them as being dictated by the administration, especially if the program could mean job loss; administrative support for the program is essential to create an effective environment for risk-taking (Stasz, 1992).

Teacher Roles

A school's failure to recognize the importance of adequate staff training and curriculum development will hinder integration efforts. Teachers have new roles, a greater need to collaborate, and new students to teach. These alterations in roles and responsibilities affect teacher morale and require administrative support and time to adjust. In addition, teacher union contracts need to permit these changes in teachers' responsibilities (Stasz, 1992).

Vocational Education as Part of General Education

Defining Characteristics

In this option, there is no dichotomy between vocational and academic. The traditional concept of vocational-technical education as training to perform in specific job areas—agriculture, home economics, industrial arts, and business—is replaced by a vision of vocational-technical education as part of general education. "General education" organizes the curriculum around the learning necessary to carry out a "vocational life"—that is, work life and family life—by integrating the academic disciplines into the study of vocational education and combining them with life-skills education. This option can be visualized as coming into being at the place where the overlapping circles of traditional vocational education, academic education, and general education intersect (Beck, 1990, 1991; Copa, 1992; Copa & Tebenhoff, 1990).

In this vision, technical skills instruction is no longer the essence of vocational education. Instead, this option deals with broad concerns such as developing general life competence (problem-solving, metacognitive processes, communication skills, and leadership), the rights and responsibilities of vocational life (e.g., the distribution of power and authority at work and in the family), relationships in vocational life, technology in vocational life, vocational life competence (e.g., vocational and life skills), and managing vocational life (e.g., life style and resource allocation) (Beck, Copa, & Pease, 1991). The aim is to develop students who are informed, competent, and oriented toward meeting the social, political, vocational, and personal requirements of adult life.

In the curriculum there is a shift away from considering subject matter as independent and separate to a coordinated and integrated view of a subject in all of its conceptual, representational, and interpretative aspects. This makes the curriculum meaning-driven, context-sensitive, and value-laden (Copa & Pease, 1992).

Vocational education as general education in the comprehensive high school can be organized in a number of different ways—by house plan, career path, school-within-a-school, long-term project, or other arrangements. Whatever the organization, it is intended to support the integration of all disciplines and eliminate the stratification of vocational-academic learning common in almost all comprehensive high schools. The school is organized to allow for flexible time schedules to allow students to become progressively more knowledgeable about a particular subject. Community settings and places of paid and unpaid work and service are also considered learning settings in partnership with the schools. Businesses, parents, and community organizations are supposed to have a role in shaping the curriculum and should assume a collective responsibility for the student's lifelong learning (Copa & Pease, 1992).

The main approach for restructuring the delivery of curriculum and instruction is teacher collaboration and innovation and differential patterns of staff-student interaction. Teachers would be given time for joint planning and could work with students in such structures as "house plans," in which they would teach core subjects; support staff would provide special services; and a coordinator would organize the "house." Teachers and other staff would establish cooperative learning situations for students as well, with opportunities for considerable departure from traditional relationships between teachers and individual students or the whole class (Copa & Pease, 1992).

Development and Implementation Status

This restructuring option is currently at the design stage, although parts of it likely are driving a number of local efforts to upgrade general education in local comprehensive high schools.[12]

Outcomes

Since this option has not yet been tried in its current design, we have no sense of its impact on learners.

Strengths and Weaknesses in Meeting the Design Criteria

The design elements are too unspecified to judge this option on the criteria presented in this paper.[13] This option is not driven by a developed theory of learning; it has no fully articulated curricular or instructional strategy for providing educationally rich learning or for creating communities of expert practice. Without such a theory or strategy, it can easily deteriorate into a form of traditional general education, which has failed to provide most youth with the knowledge and skill for postsecondary education and work. Further, it has no links to employers and does not guide students along career paths.

Barriers to Diffusion

The spread and implementation of this option depends on the full acceptance by our society of the role of the school as an agent of socialization and development rather than as one only transmitting knowledge and training. This would have to be reflected in professional development programs, certification requirements, and standards for the schools.

---

[12] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

[13] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

Career Magnet Schools

Defining Characteristics

Career magnets provide both career and college preparation by integrating vocational and academic education within a "theme" or "focus" school. Unlike other types of magnet schools, most of which are structured around a specific academic discipline or one of the fine arts, career magnets organize vocational and academic training around the demands of an industry such as aviation, agriculture, or fashion. Career magnets should not be confused with traditional vocational schools, which often isolate the least academically prepared and most troublesome students in vocational classes outside the mainstream of academic training. Career magnets provide a vocationally and academically integrated education for all students. Academic subjects are taught as related and functional disciplines, contextualized and given shape by the school's career theme. Similarly, vocational classes are developed and taught to provide a broadly applicable framework for the academic disciplines while also giving students skills that are directly relevant to future careers.

Rather than being conceived as a program providing limited job-specific or industry-specific "skills"—such as, for example, auto repair—to students with limited academic potential, education in career magnets is a coherent program for providing wider and more generic skills—such as problem-solving skills and the ability to transfer skills and knowledge from one situation to another—to all students. The school's career orientation grounds cognitive development in a practical and hands-on setting, allowing students to improve their conceptual and academic faculties as well as to gain directly applicable, job-related skills.

Career magnets share some fundamental characteristics with other magnet schools, which distinguish them from traditional comprehensive schools (Inger, 1991; Mitchell, Russell, & Benson, 1989). First, because both vocational and academic classes are taught within the context of a unified and coherent theme, the curriculum is aligned in a way impossible in the "shopping mall" model of the traditional high school. Second, career magnets are not neighborhood schools like the zoned comprehensive high schools but are open to students from throughout the school district. Students (and their parents) choose the school; they do not attend simply by virtue of the locale in which they live (Crain, Heebner, & Si, 1992). Finally, there is less tracking in career magnets than in comprehensive high schools. Thus, as Grubb et al. (1991) suggest, career magnets reduce the familiar separation of students into vocational and academic tracks based on the schools' perceptions of students' abilities.

Career magnets vary greatly in their formal structure. Some follow the "academy model" in which the magnet is a separate program (with a distinct student body) or a school-within-a-school (forming only part of a larger comprehensive school). Other career magnets operate school-wide; in these schools, the entire student body follows the vocational/academic curriculum, and all courses reflect the school's career-oriented theme (Grubb et al., 1991).

The structure of the curriculum of career magnets varies from school to school. Some have a degree of freedom from district- or state-wide mandates and requirements and are able to tailor their programs according to their theme and the precise needs of their students (Hill, Foster, & Gendler, 1990). Others must adapt their programs to more-or-less stringent district or state requirements. In general, though, courses of study at career magnets tend to be more structured than at comprehensive schools. As a result, students must choose an area of specialization early on and often find it difficult to change focus because of the curricular requirements. In addition, career magnets offer fewer electives and utilize a longer school day with less free time for students (Hill et al., 1990; Mitchell et al., 1990). The school's focus gives it an explicit, clear set of desired learner outcomes and a teaching and administrative staff identified with the school's purpose and outcomes.

Career magnets are also organized to provide a kind of in-school apprenticeship experience for students. The curriculum unites theory and practice in both vocational and academic classes, reinforcing broadly applicable problem-solving skills (Grubb, Brown, Kaufman, & Lederer, 1990).

The career magnet model also allows for a clearer, more fully articulated "contract" between the school and its students, promising a greater assurance of future success to the students in exchange for better learning and enhanced motivation. The promise of a future career is especially significant in the inner city. In addition, because students generally prefer work to school, the creation of schools that "feel" more like work improves both behavior and achievement (Heebner, Crain, Kiefer, & Si, 1992). Career magnets maintain strong links with local business and industry, both as a way of obtaining technological and economic resources and as a source of practical, hands-on experience for their students, primarily in the form of work-study programs and internships. Because the curricula of career magnet schools are directly focused on specific industries, they are better able to forge these links; the relationship between school and industry is collaborative rather than simply a mechanism for patronage.

Development and Implementation Status

Magnet schools in all their manifestations—career or disciplinary—are increasing presences in large-city school districts. They were first developed in the 1970s, primarily as tools for desegregating large urban school districts. The focus on racial equity in urban schools remains, but schools are now also designed to improve the quality of education. Because of their educational quality, school climate, and links to business and industry, many good stand-alone vocational high schools have some of the characteristics of career magnets, without the designation.[14]

Outcomes

We do not yet have systematic information on the impact of career magnets on learner outcomes, but Crain et al. (1992) and Heebner et al. (1992) are studying the effect of career magnets on gains in reading scores, attendance, credits toward graduation, and the passage of statewide tests on students randomly assigned to the career magnets in New York City. The Board of Education's random assignment system for placing students either in these schools or in their neighborhood comprehensive school provides a natural experimental research design for comparing the effects of each educational option on learner outcomes.

After the first year, it was found that students with previously weak academic records who were randomly admitted to a career magnet through a lottery performed better in the ninth grade than students with the same educational background who remained in their neighborhood comprehensive high schools. The reading scores of students in the career magnet schools improved, and students earned more course credits. However, students with the lowest reading scores who were randomly assigned to the magnet schools did not benefit as much. Although they were less likely to drop out than their counterparts in the neighborhood comprehensive high schools, their absence rate was high, and their reading scores did not show any more improvement than those of the students in the comprehensive high school (Crain et al., 1992).

---

[14] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

In interviews with students, faculty, and administrators, conducted to explain these outcomes, it was found that the career focus of a school was a motivating factor in student learning, particularly in their planning for a career future that included taking both vocational and academic courses. However, the teachers and administrators generally felt that magnet schools had a great deal of difficulty meeting the educational needs of those students with poor educational backgrounds randomly assigned to the schools, particularly in providing them necessary guidance and counseling services (Heebner et al., 1992).

Strengths and Weaknesses in Meeting the Design Criteria/Barriers

Because of the similarities of career magnets and academies, we have combined these discussions in the corresponding section under "Academies" below.

Academies

Defining Characteristics

Career academies resemble career magnets in that both organize the core curriculum of the high school around a career-related theme and both have student bodies who have volunteered for the program. They differ from most career magnets, however, in that the academies are always school-within-schools rather than whole schools and traditionally they target students thought to be in danger of dropping out—unlike career magnet schools which are open to all students. Increasingly, however, academies are enrolling a broader cross-section of students defined by their interest in a particular career rather than just their risk of dropping out of school. Like career magnets, academies prepare students both for work and college attendance because the vocational coursework is occupationally relevant and the academic coursework is sufficiently rigorous for college preparation. In the magnets and academies as well, then, there is no need to sort students into college-bound and noncollege-bound tracks (Stern, Raby, & Dayton, 1992).

The educational aims of the career academy include developing and sustaining a fully integrated curriculum, facilitating the students' transition from school to career, developing teacher professionalism and collegiality (enhanced by the autonomy and interdisciplinary collaboration possible within a career academy), and building a sense of community uniting administrators, teachers, students, and parents.

The academies can be defined by several essential characteristics. First, they are always school-within-schools, run by a small team of teachers from various disciplines, instructing a subset of students taking common courses; and although they are most common in the high school, they may actually exist at any grade level. Second, each academy focuses on a set of careers in fields with high demands and many employment opportunities, rather than on training for a specific job as is the case in traditional vocational education. Third, the curriculum integrates vocational and academic content and offers instruction in general employability skills. Fourth, employers from the career field are directly involved in program planning, developing the vocational components of the coursework, and acting as informal staff (e.g., as speakers, supervisors, and mentors). They also provide summer and school-year employment in the career field as part of the curriculum.

Development and Implementation Status

Academies exist in a number of forms in the United States, but not all of them have a career focus or follow the well-integrated curricular and organizational model with links to the business community. Career academies following this model exist primarily in California, Philadelphia, and New York City.[15]

Outcomes

There are findings to suggest that an academy experience can prevent students from dropping out. Some evaluations have found that academy students performed better in school than comparison groups from the same school and that a larger proportion received their high school diploma. Other findings indicate that, after graduation, the potential dropouts in these programs were either employed, serving in the military, or continuing their education (Stern et al., 1992). However, longitudinal surveys of the California students find no fundamental difference in the patterns of employment and postsecondary schooling of academy and non-academy students (Dayton, Weisberg, & Stern, 1989).

---

[15] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

Strengths and Weaknesses in Meeting the Design Criteria (Career Magnets and Academies)

Career magnets and academies do well in creating educationally rich learning situations that reflect the knowledge demands of work contexts in which the knowledge is to be used and in creating a community of expert practice. They do well in developing knowledge and skills efficiently—particularly in individual units, but less so in sequences. Career magnets and academies do well in engaging employers in curricular design, the creation of work experience positions, and commitments to hire graduates. Career magnets and academies have the potential to make the relationships and tradeoffs among various training investments transparent for students. Career magnets tilt toward advantaged students; academies tilt toward the less-advantaged.[16]

Because of their career focus, career magnets and academies are designed to provide an education closely linked to the learning and performance demands of the workplace. Career magnets and academies are the natural organizational arrangements for the problem-centered education that we associate with cognitive apprenticeship and vocational and academic integration at their best. Magnets and academies are designed to make educationally rich subject matter more available to those students traditionally denied access to such an education; academies have already reduced dropout rates, in part because the career-oriented focus with real-world applications is more engaging and motivating to students (Stern et al., 1992).

Some of the instruction replicates the workplace itself. However, to meet district and state requirements, magnets and academies maintain the traditional divisions between vocational and academic education, an approach that prevents the full creation of a community of expert practice.

Although career magnets and academies could be constructed to provide an efficient development of skills leading to progressively more advanced employment, their current design does not allow for it. Education in career magnets and academies is not part of a sequence of articulated learning among the secondary school, the community college, and the workplace.

---

[16] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

Nonetheless, these options provide counseling about the tradeoffs of training investments. Moreover, representatives of local businesses participate in the curriculum, and students have opportunities for work experience linked to their coursework. Graduates of the academies frequently get preferential hiring treatment.

Unfortunately, many career magnets "cream" the best students away from the zoned comprehensive high schools. To this extent, magnets can be captured by those already prepared to take advantage of the opportunities they present. Also, more-advantaged families have more access to information about these programs; others may not even know they can choose to enroll in them. Academies are particularly accessible to students who may be academically unprepared; as a result, academies often must provide remedial or basic skill instruction. This pattern tilts academies toward the less-advantaged.

Barriers to Diffusion

Career Magnets

In order to succeed, career magnets must be created from the ground up rather than as piecemeal efforts at reform (Grubb et al., 1991). Also, because they require specialized equipment and resources, career magnets cost more than traditional schools, especially in the early stages of development and especially in certain occupational fields (Mitchell et al., 1989). In the long run, the concentration of vocational programs at a single site may allow more cost-effective allocation of funds; however, in this time of fiscal constraints, many districts are hesitant to channel scarce resources away from comprehensive schools.

Because many vocational programs have functioned primarily as schools-of-last-resort for many minority students and students with academic and discipline problems, the integration of these programs in career magnets faces serious challenges. Selvin et al. (1990) suggest that career magnets might be perceived as segregated schools for minority and noncollege-bound students.

Increasingly rigorous graduation requirements make the development of magnet schools difficult, since they are often perceived as a diversion of resources and attention from the basics of the academic curriculum (Grubb et al., 1991). District policies and teacher union contracts often make school-based hiring of teachers and reformation of the curriculum difficult (Hill et al., 1990; Mitchell et al., 1989).

Some of these constraints—especially budgetary limits—are reflected in certain problems within existing career magnets. Crain et al. (1992) and Heebner et al. (1992) have found that New York City's career magnets have not been as successful in educating students with very poor academic records as they have been with students with average records. They attribute this primarily to the lack of resources for adequate remedial and counseling services for these students, and they argue for additional resources to reduce the workload for overburdened school counselors.

Academies

Academy programs confront many of the barriers that career magnet schools and many other options face, particularly in the collaboration of teachers and leadership. In addition, they can easily be perceived as favoring some students over others; as draining resources from the school's normal programs; and as "creaming" off the best students, leaving the host school to deal with disadvantaged and difficult students. This makes the program vulnerable in a competition for scarce resources.

What is more, although the partnership between the school and local employers is an essential component of the academy model, such partnerships are usually not articulated sufficiently to make coursework and work experience complementary. Most schools and workplaces are loosely coupled because under current conditions they do not have natural links; educators involved with academies have, however, created a business commitment that is deeper than in some other options.

Work-Based Youth Apprenticeship

Defining Characteristics

The current interest in work-based youth apprenticeship in the United States is inspired less by traditional American apprenticeships in the trades than by the German dual[17] (apprenticeship) system for young people. Although standard American apprenticeship programs often provide high-quality skills training, they are limited primarily to the building trades; they serve few individuals—only 300,000 are currently enrolled; and they focus on the not-so-young. Less than twenty percent of apprentices nationwide are under the age of twenty-three, and the average age is twenty-nine (U.S. Department of Labor, 1989; U.S. General Accounting Office, 1990).

---

[17] The "dual" refers to the fact that German youth apprenticeship combines a work-based and a school-based educational strategy.

Interest in apprenticeship as the basis for educational reform arose from the perception that European apprenticeship systems avoid many of the weaknesses of U.S. education and from a growing body of findings on the educational advantages of integrating school instruction with nonschool experiences at work.

While college-bound students in the U.S. are guided and counseled through the college selection and application process, the noncollege-bound are on their own. They often drift from one unskilled job to another, learning no skills, and working mainly with other unskilled young people. This system wastes time and delays maturity; whatever training that takes place is haphazard and does not result in any recognized credentials or certification.

In German youth apprenticeship systems, on-the-job training occurs under the supervision of certified trainers, and the apprenticeships provide a credential that is recognized throughout the country. Adolescents are quickly moved into the workplace, where they work with mature role models. In addition to acquiring relevant workplace skills, apprentices are socialized into the nonschool world.

Bailey and Merritt (1992) point out that while the American version of the German dual system has no fixed definition, four components are at its heart:

1. *Target population.* It is designed to be an integral part of the basic education of a broad cross-section of youth. It is not equated with programs for specific occupations or with narrowly defined target groups such as at-risk youth.

2. *Educational content.* Its educational content integrates and coordinates vocational and academic education. Apprenticeship programs are designed to teach broad employability and social skills. The adults in the learning situation play the roles of coach and mentor.

3. *Location of instruction.* A significant part of the basic education program takes place on the job, to be complemented by classroom instruction.

4. *Credentials.* Apprenticeship has a system of stringent vocational/academic credentials for students who successfully complete the program. It presumes that employers will recognize these credentials as certifying achievement of specified levels of skills.

Development and Implementation Status

This model is partially developed. As a full-blown model, its implementation is limited to a small number of pilot or demonstration projects in several states with a small number of students.[18] However, the model is extensively implemented in ad hoc and partial form, if we treat cooperative education as a partial and less specified version of work-based apprenticeship. (See "Cooperative Education" section.)

Outcomes

As yet, there are no systematic outcome data. In the U.S., this option is still in its infancy, with the effort now beginning demonstration projects.

Strengths and Weaknesses in Meeting the Criteria

Work-based youth apprenticeship has strong potential to (1) set up educationally rich learning situations that reflect the knowledge demands of the work contexts in which knowledge is to be used; (2) create a community of expert practice; and (3) develop knowledge and skill efficiently; however, its strength in these areas depends on the nature of the workplaces it selects. It does well in engaging employers in curricular design, the creation of work experience positions, and commitments to hire its graduates. It only moderately meets the criterion of making the relationships and tradeoffs among various training investments transparent for students. It could be seen as an option for the less-advantaged only.[19]

Work-based apprenticeship presumes well-developed relationships with employers for learning and placement purposes. This option automatically ensures a learning situation that reflects the knowledge demands of the workplace. But much depends on the workplace selected: If a work-based youth apprenticeship system is carried out in a normal

---

[18] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

[19] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

sample of workplaces, it will include many that organize work—and thus learning—as a set of simplified, segmented tasks that are neither educationally nor problem-rich. Clearly, the nature of the work context has to be monitored carefully.

The embeddedness of the learning within a work situation also makes it harder to ensure that apprentices develop an understanding of the principles that govern a domain under study. This understanding emerges as learners grapple with issues and problems outside of the limits of a given situation. Collins et al. (1989) point out that, in contrast to cognitive apprenticeships, the problems and tasks given to learners in standard, work-based youth apprenticeships arise not from pedagogical, but from workplace, concerns.

> Cognitive apprenticeship selects tasks and problems that illustrate the power of certain techniques, to give students practice in applying these methods in diverse settings, and to increase the complexity of tasks slowly so that component skills and models can be integrated. Tasks are sequenced to reflect the changing demands of learning. Letting job demands select the tasks for students to practice is one of the great inefficiencies of traditional apprenticeship. (p. 459)

A defining characteristic of apprenticeship is learning in the context of a community of practice, where the master's role is that of coach. The American model of work-based youth apprenticeship adds the adult role of mentor. The weakness here is that the option presumes, but does not make explicit, the importance of a community of *expert* practice. Scribner and Sachs (1990) found that informal on-the-job training can be catch-as-catch-can. Its quality depends heavily on who happens to be around to train. In work groups with high turnover, almost-novices train novices, a situation that violates all models of good apprenticeship training. Even experienced members of a group can only pass on their understanding of the job and the corporate context in which this is embedded. This understanding is rarely monitored and can vary wildly.

Like cognitive apprenticeship, work-based youth apprenticeship has no design elements that we would expect to increase the efficiency of learning *sequences*. However, Collins et al. (1989) note the motivating quality of work-based learning, a quality that should lead to more learning within a given time frame:

> Apprentices are encouraged to quickly learn skills that are useful and therefore meaningful within the social context of the workplace. Moreover, apprentices have natural opportunities to realize the value, in concrete economic terms, of their developing skill: well-executed tasks result in saleable products. (p. 459)

Although the motivating quality of work-based youth apprenticeship means that individuals will learn whatever is to be learned quickly, it is firm-specific job demands, not pedagogy, that drive the problems and tasks. This means that the "curriculum" of work-based youth apprenticeship is more apt to have learning gaps and unnecessary repetition. Theoretically, work-based youth apprenticeship curricula can be designed to eliminate this problem, but its dependence on employers and workplaces may make it difficult to modify these connections for pedagogic purposes.

Work-based youth apprenticeship is unique in its design element of a skills certification system. Although it has not resolved the issues surrounding the creation of such a system, it nonetheless identifies such a system as critical to the option. A standard-setting and skill-certifying system can start to organize employers' recognition of skill, thus encouraging employers to hire the option's graduates.

Work-based youth apprenticeship could partly meet the criterion of helping to clarify the tradeoffs between different training investments. It presumes a credentialling system, and the success of program graduates in qualifying for skill certificates can be used to signal the quality of particular training programs. Although this option is not designed to convey training payoffs or to reveal the career paths among a family of occupations, its design elements are not antithetical to showing these relationships and tradeoffs.

Work-based youth apprenticeship is vulnerable to becoming an option solely for the socially, economically, or educationally less advantaged—not in design, but in perception. Although it is designed as an integral part of the basic education of a broad target population of youth, historically, apprenticeship in the U.S. was for the trades; thus, it was restricted to the less advantaged and divorced from college-going. The early returns from apprenticeship demonstrations show that parents are reluctant to place their children in work-based apprenticeships because they believe that they foreclose college possibilities.

There is also the problem of inequality and stratification within the workplace. As schools are rife with unequal allocation of resources and tracking, so is the workplace. Even the much-admired German apprenticeship system is stratified. For example, in 1990, less than thirty percent of Turkish fifteen- to eighteen-year-olds participated in the German apprenticeship system. When they participate, they are concentrated in the lower-skilled jobs that offer little opportunity of transition to "skilled worker" status. Further, the German apprenticeship system is stratified into two broad employer sectors: "craft" and "industry and commerce." The craft sector uses apprentices as low-cost workers rather than as future skilled employees, and immigrant youth are overrepresented in these less desirable apprenticeships (Bailey & Merritt, 1992).

Barriers to Diffusion

The principal barrier to widespread diffusion is the level of employer involvement implied by the youth apprenticeship model, which calls for the transformation of workplaces into integral parts of the nation's basic education system. We can ask whether employer interest will be sufficient to support widespread implementation of this system in two ways. Why might employers be willing to participate in an apprenticeship learning system? And why not? Bailey and Merritt (1992) identify three incentives that employers might have: (1) a sense of collective responsibility; (2) direct interest in apprentices as future employees, where training costs are considered investments in the future of their own operation; and (3) interest in hiring lower cost workers.

A sense of collective responsibility is a weak reed, as we have discovered in other business relationships with schools. These relationships often depend on a single business executive and collapse when that person leaves. Or they are defined from the corporate perspective as "community relations," which marginalizes corporate involvement.

Interest in apprentices as future employees is also a weak incentive. Employers know that young workers in the U.S. have a history of high turnover, even though a substantial share of this turnover has to be attributable to exactly the problem that work-based youth apprenticeship is designed to solve—lack of coherent training for the workplace. Further, although analyses show that employer-sponsored training reduces turnover (Mincer, 1989; Vaughan & Berryman, 1989), many employers may not have enough openings to hire all the apprentices that they train. This happens with smaller employers in Germany (Bailey & Merritt, 1992).

The third incentive, using apprenticeship to hire lower-cost employees, has no power. American employers can hire youth at low wages now without resorting to apprenticeship. This is not the case in Germany, where employers are much more constrained in their ability to pay low wages and can use the apprenticeship mechanism to hire cheaper labor.

We give weight to the negative incentives. There are two: (1) employer disincentives to train the less educated and inexperienced, and (2) disincentives to train in general. Although these patterns could change, employers now tend to focus their formal training on the better educated and on the not-so-young (Tan, 1989). Thus, employers' training policies, staffing, and arrangements are structured for an older and better educated group than we envision for work-based apprenticeship. The fact that cooperative learning, a cousin of work-based apprenticeship, has remained a minor work-based educational alternative in the United States is consistent with these traditional investment patterns.

Employers' traditional training patterns reflect structural arrangements and economic incentives that isolated policy incentives cannot be expected to change. For example, a mass production organization of work generates the need to train technical specialists, supervisors, and managers, not novices or inexperienced workers in low-skill occupations (Berryman & Bailey, 1992). When companies shift from mass to flexible organizations of work, their training patterns shift to include all workers; but these shifts are in response to economic incentives.

American employers are also generally less inclined to train than some of our competitor nations such as Germany or Japan (Mincer & Higuchi, 1988). Americans deeply value individualism and free markets, which in the workplace shows up in tenuous commitments of management and workers to one another. Employers have the flexibility to fire and employees the flexibility to change jobs. These relatively tenuous ties between American workers and employers affect the incentives of both parties to invest in skills.

This cross-national difference manifests itself in various ways. For example, during recessions, the data shows that American companies tend to maintain stock dividends and fire workers; Japanese and European employers tend to reduce dividends and retain workers (Lichtenberg, 1992).

Exacerbating these tenuous ties is how the United States finances various social benefits such as health care and family leave. Allocating the costs of these benefits to employers in the United States further weakens employer-worker ties in that it creates an incentive for employers to resort to contract workers that are ineligible for company benefits.[20]

If even moderately ambitious youth apprenticeship proposals are to become reality, they have to address two fundamental issues: (1) employer participation and (2) work-based learning. These two issues are linked: If employers have to be cajoled into participating, educators lose their leverage to demand that employers improve the educational experiences that they offer apprentices.

In other words, we have to face the possibility of a conflict between apprentices' learning interests and employers' production and cost interests.[21] Since the market will not provide incentives for firms to search out the best educational strategies, we will need institutions that can regulate and monitor the quality of work-based learning.

Cooperative Education

Defining Characteristics

Relative to cognitive apprenticeship and work-based youth apprenticeship, today's cooperative education has less well-specified, defining elements. The first high school cooperative education program in 1908 in Fitchburg, Massachusetts, was highly structured and would be better classified as an apprenticeship program. Written contracts were drafted between parents, students, and manufacturers that specified a four-year commitment for all who participated. The first year was exclusively dedicated to academic training in mathematics, English, science, and drawing. The following three years alternated weekly between shop and school, and completers of the four-year program were accorded beginning journeyman status (Bailey & Merritt, 1992).

---

[20] A recent *Washington Post* newspaper article reported that "analysts such as Richard Belous of the National Planning Association estimate that as much as 30 percent of the entire U.S. work force is now considered part-time or contingent." The article also quoted Dan Lacey, editor of *Workplace Trends*, which tracks corporate staff cuts. Lacey stated that "there is not an informed employer in America who wants to create an employment relationship. Nobody wants employees." Lacey testified before the U.S. Congress' Joint Economic Committee that "although most of corporate America is hesitant to admit it because of potential political liabilities, the hard truth is that it is becoming standard management practice in U.S. corporations to cut permanent staff to the absolute minimum number of persons required to continue profitable operations" (Skrzycki, 1992).

[21] This is less a problem in Germany because longstanding social contracts between employers, unions, government, and the educational sector align apprentices' and employers' interests better.

Today's cooperative education, which exists at both secondary and postsecondary levels, is less formal and standardized (Bailey & Merritt, 1992; Stern, 1990). High school cooperative education students usually spend the morning in school classes recommended and approved by the school coop coordinator and the last half of their day working in a paid job for which they receive credits toward graduation. Cooperative education presumes to alter the work process to facilitate learning, with the classroom instructor arranging job placements and writing a training plan that specifies what each student is expected to learn on the job. The student's work supervisor evaluates the student's performance relative to these training objectives. The classroom instructor usually has release time to visit students' job sites to monitor the training.

Cooperative education students do not usually have specially designed school coursework; they attend traditional vocational and academic classes with noncooperative-education students.

Whereas apprenticeship is seen as the first job in a career sequence, cooperative education is more often viewed as a temporary training station (Stern, 1990). Cooperative education is not intended as a national preparation system; most cooperative education arrangements are worked out locally between individual employers and school staff and are subject to various state laws and local customs. Although it uses the workplace as a learning site, cooperative education makes a less purposive use of it than youth apprenticeship. Cooperative education has no system of credentials, relying on letters of recommendation from employers. The time spent by students even in high quality coop programs "is not widely recognized as evidence of skill mastery" (U.S. General Accounting Office, 1990, p. 3). Its benefits are early workplace exposure, which will lead to employment after graduation; wages received while in high school; and credits toward high school graduation.

Development and Implementation Status

Cooperative education is a mature option; it was mandated for the secondary level in the original Smith-Hughes Act of 1917, and the Vocational Education Amendments of 1968 provided categorical support for it. Four-year colleges and universities started a number of cooperative education programs between 1906 and 1926, and seventeen of these were still active in 1987 (Stern, 1990).

However, although there is general consensus about its elements, they are not as clearly specified as those of other options. They are also not sufficiently defined to provide a grounded sense of what their implementation should look like.

The option is quite widely distributed across secondary and postsecondary schools. Stern (1990) reports that the 1987 survey of cooperative education programs found these programs in 437, or in about a third of, two-year colleges and in 549, or in about twenty-eight percent of, four-year colleges. In 1981-1982, 81,500 were enrolled in cooperative education in two-year colleges, or less than two percent of the total two-year college enrollees for that year. The picture had not changed by 1987, when 78,000, again less than two percent, were enrolled in cooperative education in two-year colleges (U.S. Department of Education, 1991). In 1981-1982, 648,500 students were enrolled in secondary cooperative vocational education, or about eleven percent of those enrolled in the eleventh and twelfth grades. The number in secondary cooperative education had declined to about 430,000 by the 1989-1990 school year, or to about eight percent of enrolled juniors and seniors (U.S. General Accounting Office, 1990). The decline seems attributable to the states' increase in the numbers of academic courses required for high school graduation (Stern, McMillion, Hopkins, & Stone, 1990). Although the program is widely distributed across schools, cooperative education is a relatively marginal activity within schools. It does not penetrate the organization of learning.[22]

Outcomes

In their review of research on cooperative education, Stern, Hopkins, Stone, & McMillion (1990a) cite the earlier Leske and Persico (1984) synthesis of results for five outcomes. Economic outcomes, including earnings and employment, have not been found to be consistently better for individuals who participate in cooperative education, even though cooperative education students tend more often than regular high school vocational education students to find jobs related to their training. For example, Hernstadt, Horowitz, and Sum (1979) compared outcomes for students in four programs: (1) cooperative vocational education, (2) regular vocational education, (3) work study, and (4) the "general academic" program. Cooperative education students did not have significantly higher labor force participation rates, obtained more weeks of employment, earned higher wages, or encountered lower unemployment rates than those in regular vocational education or the general academic program either during the high school years or at the eighteen-month post-high school follow-up. At the same time, cooperative education students were significantly more likely to value the jobs that they held in high school, received on-the-job training from their employers in high school, claimed their jobs had positively affected their decisions to stay in school, attended classes during their senior year, obtained full-time jobs immediately after graduation, obtained jobs related to their high school cooperative education program, and were more satisfied with their jobs.

---

[22] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

On some measures, educational outcomes have been worse: For example, cooperative education students plan to take less postsecondary education than other high school students in regular vocational education. In terms of "social" outcomes, there is no consistent evidence that cooperative education students show less delinquency or higher voting rates. On "personal" outcomes, cooperative education students usually express more satisfaction with school but no consistent difference on occupational knowledge or "affective" (emotional) competence. Finally, cooperative education programs have not been found to contribute consistently to equity. As Stern, McMillion, Hopkins, and Stone (1990) summarize the evidence, "The research does find that coop students are relatively satisfied with school, but there is no consistent evidence that they learn more, become more productive, or find better jobs. Why not?" (p. 381). In response to their own question, Stern, McMillion, Hopkins, and Stone observe that the research on cooperative education is methodologically flawed.

First, in some studies, cooperative education students are lumped together with students from other programs such as work-study, where the link between classroom instruction and job experience is less strong. Second, cooperative education programs themselves vary, the difference between "specialized" and "diversified" programs being most relevant to outcomes. Third, the research thus far covers short time frames, follow-up studies of cooperative education students running a maximum of two years. Depending on one's theory of the timing of effects from cooperative education, these shorter time frames may or may not be adequate.

Finally, and perhaps most important, the research has not usually measured variation in the quality of cooperative education jobs. The prevailing assumption seems to have been that variation between these jobs is small, relative to the difference in quality between cooperative education and noncooperative education jobs; but as Stern, McMillion, Hopkins, and Stone (1990b) pointed out, this did not seem likely.

A national longitudinal study designed to eliminate these methodological problems was started in 1988. A main objective was to assess the effects of the quality and quantity of school-based work experience on educational, economic, social, and psychological outcomes for high school and for college cooperative education students.

Without going into great detail, we now know that, on average, the quality of cooperative education jobs is superior to the standard jobs that students not in cooperative education obtain. These results seem to hold for both high school and two-year college students.

Although the design of this study lets us test the proposition that there is no difference in quality between cooperative education and noncooperative education jobs, Bailey & Merritt (1992) note that the comparison groups of the study do not shed light on the payoffs of cooperative education versus other work-preparation options.

Two important issues that need to be addressed are (1) whether a significant part of the education of the nation's youth should be moved from the classroom to the workplace, and (2) whether one versus another work-based option is more successful. Jobs held during school are ad hoc, not a work-preparation system. Thus, comparisons of outcomes of cooperative education jobs versus jobs held during school get neither at the question of school-based versus work-based educational options nor at the question of one versus another systematic work-based option.

Strengths and Weaknesses in Meeting the Design Criteria

This option has no relevant design elements for creating educationally rich learning situations that reflect the knowledge demands of work contexts in which the knowledge is to be used or for creating a community of expert practice. It moderately meets the need to develop knowledge and skills efficiently. Cooperative education creates work experience positions but is not connected to any system of skill credentials; therefore, it only moderately satisfies the criterion to engage employers in curricular design, the creation of work experience positions, or commitments to hire its graduates. It does poorly in making the relationships and tradeoffs among various training investments transparent for students. Cooperative education tilts toward the less-advantaged.[23]

Assessing this option against the design criteria reveals an option undeveloped as a preparation system. Although individual co-op programs pay careful attention to what students learn in the workplace, this option does not pay systemwide attention to the curriculum and pedagogy of the workplace. The nature and quality of the learning seem ad hoc. It exposes students to the knowledge demands of the workplace; but as is the case with work-based youth apprenticeships, if it takes place in a normal sample of workplaces, it will include many that are not educationally rich, that are not motivating, and that may not expedite learning. Instead of communities of expert practice, the workplaces can be communities of novices and near-novices, and this option does not specify experience levels for the adults or their pedagogic roles relative to the coop student. Individual programs undoubtedly pay careful attention to what students learn in the workplace, but the option does not appear to pay systemwide attention to workplace curricula or pedagogy.

The option does not necessarily develop knowledge and skill efficiently. It has no implications for learning sequences. Depending on how well the work-based learning situation is structured, it may or may not be motivating to students, and it may or may not expedite what is to be learned. Its lack of explicit, systemwide concern for the work-based curriculum multiplies the chances that the "curriculum" of any given learning unit has gaps and unnecessary repetition.

Cooperative education creates work-experience slots, and the school coordinators work to define the curricular designs for these slots, but the lack of a systemwide specification of what this design should look like makes it subject to variation among coordinators. Although these slots may convert into placements for students, the option is not connected to any system of skill credentials that systematizes hiring opportunities for its students.

The option has no design feature that informs students about the market payoffs of training in particular fields or about the quality of a particular training slot for a field. It has no design feature that helps students develop a conceptual map of the relationships among occupations within an occupational family. Cooperative education is more often viewed as a temporary training situation, in contrast to apprenticeship, which sees the training situation as the first job in a career sequence (Stern, 1990).

---

[23] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

Stern et al. (1992) compare the characteristics of samples of high school students from four sites who are unemployed, employed in noncooperative-education jobs, and employed in cooperative-education jobs. Although the coop students come from a range of socioeconomic backgrounds, they are less apt than the other two groups to expect to attend college, their parents have lower levels of educational attainment, and they have a smaller percent with self-reported "A" grade point averages.

Barriers to Diffusion

The implementation issues for cooperative education have less to do with getting it started and more with expanding it. This is an old and durable option. It started with more ambitious objectives and initially looked more like today's work-based youth apprenticeship. Its more modest current objectives—workplace exposure—may tell us something about the implementation problems with work-based options.

Stern (1990) is pessimistic about expanding cooperative education, at least to the point where it becomes a widespread system for a large share of late adolescents. He sees two main obstacles. One is cost; the U.S. General Accounting Office (1990) reports that a typical student load is fifty to sixty students per cooperative education coordinator. The coordinator has to locate good job placements, monitor job-site experiences to ensure that learning is actually going on, and advise students on their school courses. Since these responsibilities are now often added to an already full set of teaching responsibilities, expanding the system would require new resources.

Stern (1990) identifies the second obstacle as employers' reluctance to participate. Under the Youth Incentive Entitlement Pilot Project, employers were paid wage subsidies to provide part-time jobs to disadvantaged students. Even at a subsidy rate of one-hundred percent, only eighteen percent of employers participated, and that was for a program where employers provided *jobs*, not training. Although more employers would participate if the subsidy were not restricted to disadvantaged students, the country cannot afford a full subsidy for large numbers of students. Stern concludes that the majority of employers will not consider it worthwhile to spend much time training students, especially in the absence of significant subsidies. At the same time, Bailey and Merritt (1992) point out that no research has tried to analyze the potential for expansion by analyzing what types of employers do and do not participate and why.

School-Based Enterprise

Defining Characteristics

Stern (1990) defines school-based enterprise as an activity, sponsored or conducted by a secondary or postsecondary school, that engages groups of students in providing services or producing goods for sale or use to people other than the participating students themselves. These activities include school restaurants, house-building and other construction projects, print shops, farms, child-care centers, retail stores, hair styling, and auto repair shops. Extracurricular forms of school-based enterprise include school newspapers, yearbooks, plays, concerts, and debates.

The objectives of school-based enterprises are to teach entrepreneurship, provide application of skills and knowledge taught in other courses, enhance students' social and personal development, and stimulate economic development in the community.

Development and Implementation Status

School-based enterprise is a mature option in that it has been around for a long time. However, like cooperative education, its elements are not as clearly specified as those of other options, even though there is general agreement about what they are. These elements are not sufficiently defined to provide a grounded sense of what their implementation should look like. The number of projects and number of students does not seem known. However, where it occurs, it does not seem to affect how the learning of the school is organized. Stern (1990) observes that, like moss on a rock, this option seems to exist all around the edge of the educational system without affecting its basic structure.[24]

Outcomes

We have no outcome data for school-based enterprise projects.

---

[24] For a comparison to the development and implementation status of the other options, see Summary Chart 1, page 77.

Strengths and Weaknesses in Meeting the Design Criteria

School-based enterprise has no relevant design elements for creating educationally rich learning situations that reflect the knowledge demands of work contexts in which the knowledge is to be used or in creating a community of expert practice. It moderately satisfies the criterion to develop knowledge and skill efficiently. But it is weak in engaging employers in curricular design, creating work experience positions, or commitments to hire its graduates; and it is weak in making the relationships and tradeoffs among various training investments transparent for students. This option seems neutral with regard to the socioeconomic backgrounds of its students. Although its appeal to less- versus more-advantaged students depends largely on the nature of the entrepreneurial activity itself, there is a tilt toward the less-advantaged.[25]

This option is a design for a project, not for a work-preparation system. Its advantages seem to lie in its creation of enterprises whose curricula could be educationally rich and where students could move into a community of expert practice. However, it has no systematic design elements that specify the content or quality of the curricula or the expertise of the adults in the situation. Similarly, although educators probably work with employers, there is no design specification of the employer's role, and there are no employer commitments to hire its students. It also does not clarify the relationships and tradeoffs between different training investments for its students.

It is probably motivating to students; however, its lack of curricular specification increases the likelihood of gaps and unnecessary repetition in the learning.

Barriers to Diffusion

Although this option avoids the need to recruit and retain employer participants, it is hard to see that it could be expanded to involve a significant proportion of high school students. Developing a teacher corps that can set up and run a business, find the capital, and develop markets for the products and services of school-based enterprises for millions of students does not seem feasible.

---

[25] For a comparison to how well the other options meet the design criteria, see Summary Chart 2, page 79.

WHERE DO WE GO FROM HERE?

No single option meets all of our design criteria, and all are missing more than one important piece. There are too many options right now; the field needs to eliminate or combine them, where appropriate, and focus its energies and resources. Whatever solution we put together must be feasible, however. Something with the body of a donkey, head of a tiger, and tail of a peacock will have flight problems.

One issue the field is struggling with—whether the solution should be primarily work-based or school-based—is not an either/or question; the question is about the solution's center of gravity. Implementation barriers; quality control issues; and governance, regulatory, and financing questions will vary, depending on which sector—the workplace or the school—carries the primary teaching and learning responsibility.

Beyond a doubt, many school-based programs—even many vocational ones—are divorced from the needs of the workplace, and students emerge from these programs lacking both the knowledge and skills needed at work and the ways in which knowledge and skills are used in the workplace. From the perspective of the schools' failure, a work-based system sounds reasonable. It eliminates the problem of coordinating work-oriented schooling with the workplace because learning and the workplace are coincident with one another. It reduces the school-to-work transition problem for youth for the same reason.

However, if a work-based option solves some problems by virtue of its location, that location raises problems of its own. One major problem is not unique to a work-based system. The evidence is that both schools and workplaces are poorly designed for learning; accordingly, both face the challenge of institutionalizing powerful teaching and learning arrangements. However, a work-based system would require that employers assume heavy educative responsibility for about seventy percent of America's late adolescents.

Traditional social contracts between American employers, government, unions, and schools indicate that the employing sector cannot and will not bear this weight. It might be able to develop and maintain a high quality system that serves a small percent of eligible youth. Or it might be able to support a larger system skewed toward employers' work, not apprentices' educational interests. Our reading is that for the foreseeable future the employing sector will not support a national, work-based system that stays focused on apprentices' learning needs.

Several options (e.g., Tech Prep, work-based youth apprenticeship, cooperative education, career academies, and career magnets) want to use the workplace to provide a high quality learning experience for students. However, at this juncture, they seem to be merely settling for the presumed benefits of "exposing" students to actual workplaces.

There is another reason to think carefully about the primary location of a built middle. A fundamental impetus for work-based options is that schools generally have done a poor job of preparing the nonbaccalaureate-bound. The question is whether we let the schools avoid responsibility for this large group of students. If the workplace turns out to be the learning place of choice for this group, well and good. However, we need to be careful that we do not resort to work-based options as a way to finesse problems with the schools. We are already paying for second-chance programs and remedial college programs to do what the K-12 system should have accomplished in the first place. At the very least, if we move to a work-based system, this move should be accompanied by a shift of resources from the high schools to employers.

If we start with a school-based system, what features should it have? We propose a solution with the following design elements. These can occur in different school-based institutional arrangements: career magnets, career academies, Tech Prep programs, and schools organized around integration principles:

- *The pedagogic and curricular principles of cognitive apprenticeship.* This design decision ensures an educationally and problem-rich learning environment; a community of expert practice as the learning situation; a learning environment motivating to students; teachers in the roles of coaches; and basic properties of work contexts. It engages the head and the hand, eliminating the duality between vocational and academic. If structured according to cognitive apprenticeship principles, school-based enterprise projects lend themselves to creating work contexts for learning purposes.

- *The organizational elements of vocational and academic integration.* This design decision defines the organizational elements that need to be in place to implement the pedagogic and curricular principles of cognitive apprenticeship.

- *The articulation and occupational cluster principles of Tech Prep.* The articulation principle ensures a coherent curricular sequence across the secondary grades (and potentially across the middle and high school grades), between secondary and postsecondary schools, and across two-year and four-year colleges. The occupational cluster principle ensures broad training that positions students to move among the occupations within a cluster and that creates a cognitive map of how one moves within the cluster.

- *The rigorous skills certification system of work-based youth apprenticeship.* This system is important for three reasons: (1) if employers have a sense of ownership in the system, they are more apt to use its certificates in their hiring and wage decisions, thus organizing the market for graduates of the built middle; (2) if it is rigorous and employers use it in their hiring and wage decisions, it operates as a quality control on work-preparation programs; and (3) if it is national, it creates national markets for graduates of the built middle. National markets have been heretofore primarily reserved for the college- and professionally educated.

These elements do not ensure systematic relationships with employers for help in curricular design, work-experience slots, and hiring commitments. Several options now on the table have employer relationships as design elements: Tech Prep, career academies, career magnets, work-based youth apprenticeship, and cooperative education. Unlike career academies and magnets, Tech Prep has done little to implement this element. Cooperative education depends on these relationships, but we do not see them as models for our purposes. Cooperative education uses them more as a way of putting students into the workplace. It does not use them to continuously improve educational quality or to knit together an educational and labor market system.

Work-based youth apprenticeship also depends heavily on these relationships. By its very nature, it forces a link with employers that school-based options have to forge in some other way. However, this option is still too fluid and ill-defined for anyone to know whether and how it can generate the employer relationships that a school-based system needs.

We suspect that monitoring and analyzing the experiences of the different options, especially those of work-based youth apprenticeship, will define "best" principles and practices for working with employers.

Our proposed solution does not fully meet the fifth design criterion—clarifying the relationships and tradeoffs among training options for students. The articulation and occupational cluster principles of Tech Prep help. Any national, rigorous skill certification system can also be used to track the quality of preparation programs. Going beyond these elements probably requires a broader information system, but the ideas now being discussed in policy circles about what this should look like are vague and uncompelling.

Aside from a theory of learning that integrates head and hand/academic and vocational, our proposed solution has no other design principles that increase the chances that it will serve a socioeconomically broad range of students. Options can be designed in this way, New York City's handling of its career magnets being an example. However, we see not a single, stable design solution, but a number of ways to meet the objective.

A Word of Caution

Building the middle will require intelligent and efficient infrastructure to support the process. Within the purview of this paper, we can not address the Bermuda Triangle of regulations, rules, and requirements; but we want to alert readers to some fundamental infrastructure issues that need to be attended to. This discussion is clearly not exhaustive nor is it a review of the research. These are our ideas about the kinds of infrastructure changes that the building of a quality work-preparation system will require.

Four areas will need to be redesigned:

1. quality assurance mechanisms

2. curricula

3. professional development

4. knowledge flows

All of these have implications at the level of individual schools and school districts, but solving these problems will require national or state leadership in many institutional communities, including the assessment design community, employers and trade associations, schools of education, and teacher testing groups.

Quality Assurance Mechanisms

Quality assurance mechanisms would increase the chances of creating a quality system. Higher quality would increase the system's credibility with employers, policymakers, parents, and students and decrease the chances that another severely tracked system would emerge. Measures of quality would help the system's customers make informed choices.

There are two efforts to develop national or state student outcome measures and standards for vocational education. One, driven by the Carl D. Perkins Vocational and Applied Technology Act of 1990, mandates a state-based system but gives substantial latitude to states and localities. The other effort is national: The U.S. Departments of Labor and Education have funded several pilot studies to identify the issues involved with creating industry/occupational skill certifying boards (Berryman & Rosenbaum, 1992).

Whatever outcome system is chosen, it must be recognized that conventional measures of student learning (e.g., multiple-choice tests) are ill-suited to the learning objectives of options for building the middle. Authentic assessments support the educational objectives better because they measure what students know and know how to do in contexts that reflect real work situations (Hill & Larsen, 1992).

Curricula

Whether work-based or school-based, every option depends on educationally rich and problem-rich curricula that engage head and hand in meaningful contexts. Designing curricula that meet these demanding criteria will require money, time, and top-flight and relatively scarce talent. To us, this implies the need for national infrastructure to build curricula. For districts and states to try to build curricula independently is foolish. It is inefficient and wasteful because it is duplicative. Predictably, it will result in uneven or poor quality curricula.

A model of curricular development is the work of the National Council of Teachers of Mathematics (NCTM). NCTM used an impressive consensus-building and expert design process to develop a high-quality curriculum for teaching K-12 mathematics across the nation. The process involved educators at local and state levels, but it captured the economies of scale of a national, cross-state effort.

Professional Development

We see two broad issues here. The first is *teacher collaboration*. Curricular and instructional reforms and new organizational arrangements to build a quality middle will require more teacher collaboration than exists today. If collaboration is to occur and be meaningful, however, opportunities to collaborate must be visible, the resources to do it must be adequate, and the accomplishments that flow from it need to be recognized. At the very least, teachers will need common planning periods and released time to act collaboratively.

The second issue is *formal teacher education and development*, where we see three areas that will need to be rethought and redesigned:

1. States will have to rethink certification requirements in line with the changing demands of the teacher's workplace. Current state requirements do not reflect standards that the profession feels prospective teachers should meet; nor do they respond to the perceived demands of the economy (Darling-Hammond & Berry, 1988).

2. Tests for teachers must be redesigned to reflect the changing knowledge and skills that teachers need in classrooms organized to resemble the workplace. Current testing may actually discourage competent craftspersons, those most aware of the knowledge and skill demands of the workplace, from entering the profession.

3. Meeting the training needs of teachers who are asked to teach in restructured learning environments will require a very different curriculum and mix of subject matter and methods courses. Instruction in teacher education institutions may very well need to mimic the classrooms in which prospective teachers will teach, with evaluation strategies to determine whether teachers meet performance criteria.

Knowledge Flows

Successful implementations of programs depend both on having knowledge available and developing the local capacity to use it. A knowledge transfer system to build this capacity needs to be designed to allow for the regular spread of knowledge, choices for ways the knowledge can be accessed (such as clearinghouses and data files), and exchange of information. The aim would be to preserve the best documented practice and still engage practitioners in adopting and adapting it.

What is needed is a mechanism for the continuous evolution and improvement of practice. In restructuring programs to improve the education of all students, we need to understand not only their learning effects; we need to know also whether their organizational, pedagogical, and curricular *practices* are best-in-class and meet professional standards of quality. Any diffusion strategy must include an evaluation approach like benchmarking so that schools can establish measures of their own practices to determine their quality.

Conclusion

Our proposal for a national work-preparation system for middle-skill and middle-wage jobs has a school-based center of gravity but with systematic workplace connections. Careful attention to the above-mentioned central infrastructure issues will lay the foundation for the construction of a quality system. In our judgment, the approach we have outlined capitalizes on what seem to be the individual strengths of the options being tried today. If well-developed and implemented, this approach might resolve most, although not all, of the design dilemmas. More importantly, this approach offers a coherent strategy for taking seriously the education of all of our nation's students.

REFERENCES

Bailey, T. (1988). *Education and the transformation of markets and technology in the textile industry*. New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Bailey, T. (1990). *Jobs of the future and the skills they will require: New thinking on an old debate* (MDS-213, Reprint Series). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Bailey, T. (1992). *A managerial cost theory of skills*. New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Bailey, T., & Merritt, D. (1992, May). *School-to-work transition and youth apprenticeship in the United States*. New York, NY: Manpower Demonstration Research Corporation.

Beck, R. H. (1990, November). *Vocational preparation and general education* (MDS-198). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Beck, R. H. (1991, February). *General education: Vocational and academic collaboration* (MDS-057). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Beck, R. H., Copa, G. H., & Pease, V. H. (1991, November). *An uncommon education: Interaction and innovation* (MDS-140). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Berryman, S. (1991, September). *Cognitive science: Challenging schools to design effective learning environments*. New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Berryman, S., & Bailey, T. (1992). *The double helix of education and the economy*. New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Berryman, S., & Rosenbaum, J. (1992). Certification of work competencies. In L. Tredway and S. Halperin (Eds.), *Youth apprenticeship in America: Guidelines for building an effective system* (pp. 51-59). Washington, DC: William T. Grant Foundation Commission on Youth and America's Future.

Bodilly, S., Stasz, C., & Ramsey, K. (1992, May). *Policy implications of integrating academic and vocational education: An interim report.* Working draft. Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Brown, C., Reich, M., & Stern, D. (1991). *Skills and security in evolving employment systems: Observations from case studies* (MDS-131). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Collins, A., Brown, J. S., & Holum, A. (1991, Winter). Cognitive apprenticeship: Making thinking visible. *American Educator*, 6-11, 38-46.

Collins, A., Brown, J. S., & Newman, S. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing and arithmetic. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum.

Collins, A., Hawkins, J., & Carver, S. M. (n.d.). *A cognitive apprenticeship for disadvantaged students*. Unpublished manuscript.

Commission on the Skills of the American Workforce. (1990). *America's choice: High skills or low wages!* Rochester, NY: National Center on Education and the Economy.

Copa, G. H. (1992, May). *A framework for the subject matter of vocational education* (MDS-095). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Copa, G. H., & Pease, V. (1992). *New designs for the comprehensive high school: Volumes I & II* (MDS-282). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Copa, G. H., & Tebbenhoff, E. (1990). *The subject matter of vocational education: In pursuit of foundations* (MDS-094). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Crain, R. L., Heebner, A. L., & Si, Y.-P. (1992, April). *The effectiveness of New York City's career magnet schools: An evaluation of ninth grade performance using an experimental design* (MDS-173). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Darling-Hammond, L., & Ancess, J. (in press). *The implications of performance-oriented assessments for secondary school curriculum and teaching*. Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Darling-Hammond, L., & Berry, B. (1988). *The evolution of teacher policy*. Washington, DC: RAND.

Dayton, C., Weisberg, A., & Stern, D. (1989). *California Partnership Academies, 1987-88 evaluation report*. Berkeley: Policy Analysis for California Education, University of California at Berkeley.

Dertouzos, M., Lester, R., & Solow, R. (1989). *Made in America: Regaining the competitive edge*. Cambridge, MA: MIT Press.

Dornsife, C. (1992, February). *Beyond articulation: The development of Tech Prep programs* (MDS-311). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Grubb, W. N. (1991, January). *Tech-Prep programs: Issues in implementing the Carl Perkins Amendments of 1990.* (MDS-233, Working Paper). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Grubb, W. N. (1992, June). *Assessing the coordination of vocational education with other federal programs.* (MDS-444, Working Paper). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Grubb, W. N., Brown, C., Kaufman, P., & Lederer, J. (1990, August). *Order amidst complexity: The status of coordination among vocational education, the Job Training Partnership Act, and welfare-to-work programs* (MDS-063). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Grubb, W. N., Davis, G., Lum, J., Plihal, J., & Morgaine, C. (1991). *"The cunning hand, the cultured mind": Models for integrating vocational and academic education* (MDS-141). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Grubb, W. N., & Stasz, C. (1991). *Assessing the integration of academic and vocational education: Methods and questions* (MDS-445, Working Paper). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Grubb, W. N., & Wilson, R. H. (1992, June). Trends in wage and salary inequality, 1967-88. *Monthly Labor Review, 115*(6), 23-39.

Hayes, J. R., Wheelright, S., & Clark, K. (1988). *Dynamic manufacturing: Creating the learning organization.* New York, NY: Free Press.

Hayward, G., Bragg, D., Dornsife, C., & Hoerner, J. (1992, January). *Synthesis memo: Tech Prep programs.* Prepared for a meeting of the Board of the National Center for Research on Vocational Education.

Heebner, A., Crain, R. L., Kiefer, D. R., & Si, Y.-P. (1992, August). *Career magnets: Interviews with students and staff* (MDS-386). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Hernstadt, I. L., Horowitz, M. A., & Sum, A. (1979). *The transition from school to work: The contribution of cooperative education programs at the secondary level.* Boston, MA: Northeastern University, Department of Economics.

Hill, C., & Larsen, E. (1992, November). *Testing and assessment in secondary education: A critical review of emerging practices* (MDS-237). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Hill, P., Foster, G., & Gendler, T. (1990). *High schools with character* (Report R-3944-RC). Santa Monica, CA: RAND.

Hull, D., & Parnell, C. (1991). *Tech Prep associate degree: A win/win experience.* Waco, TX: Center for Occupational Research and Development.

Inger, M. (1991). *Improving urban education with magnet schools* (ERIC Digest #76). New York, NY: ERIC Clearinghouse on Urban Education, Teachers College, Columbia University.

Leske, G., & Persico, J., Jr. (1984). *Indicators of quality in corporation vocational education: A review and analysis of research.* St. Paul: University of Minnesota, Department of Vocational and Technical Education.

Levin, H. (1987). Improving productivity through education and technology. In G. Burke & R. Rumberger (Eds.), *The future impact of technology on work and education* (pp. 194-214). New York, NY: Falmer Press.

Levy, F., & Murnane, R. (1992, September). U.S. earnings levels and earnings inequality: A review of recent trends and proposed explanations. *Journal of Economic Literature, 30*(3), 1333-1381.

Lichtenberg, F. R. (1992, February 16). In a downturn, cut profits before jobs. *New York Times*, Sec. 3, p. 13.

Little, J. W. (1987). Teachers as colleagues. In V. Richardson-Koehler (Ed.), *Educators' handbook: A research perspective* (pp. 491-510). New York, NY: Longman.

Little, J. W., & Threatt, S. M. (1992, June). *Work on the margins: The experience of vocational teachers in comprehensive high schools* (MDS-166). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Mabry, T. (1988). The high school/community college connection: An ERIC review. *Community College Review, 16*(3), 48-55.

McCormick, F. (1980). *An overview of articulation efforts in vocational education: Implications for state planning.* St. Paul, MN: Educational Operations Concepts. (ERIC Document Reproduction Service No. ED 199 558)

Mincer, J. (1989). *Labor market effects of human capital and of its adjustment to technological change.* Unpublished conference paper. New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Mincer, J., & Higuchi, Y. (1988). *Wage structures and labor turnover in the U.S. and in Japan.* New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Mitchell, V., Russell, E. S., & Benson, C. S. (1990, November). *Exemplary urban career-oriented secondary school programs* (MDS-012). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Murphy, K., & Welch, F. (1988, November). *The structure of wages* (mimeo). Los Angeles, CA: Unicon Research.

National Council on Vocational Education. (1990). *"Time for action": A business, industry, and education forum.* Washington, DC: Author.

Oakes, J. (1991, November). *Blurring academic and vocational boundaries: Barriers in the cultures of large high schools.* Talk prepared for the Southern Regional Education Board, Atlanta, GA.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and monitoring activities. *Cognition and Instruction, 1*(2), 117-175.

Parnell, D. (1984). *2+2 Tech Prep/associate degree program: A working degree for America.* Washington, DC: American Association of Community and Junior Colleges. (ERIC Document Reproduction Service No. ED 255 241)

Piore, M., & Sabel, C. (1984). *The second industrial divide.* New York, NY: Basic Books.

Raizen, S. A. (1989). *Reforming education for work: A cognitive science perspective* (MDS-024). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Resnick, L. (1987, December). Learning in school and out. *Educational Researcher, 16*(9), 13-20.

Schoenfeld, A. H. (1988). *Ideas in the air* (Report No. IRL88-0011). Palo Alto, CA: Institute for Research on Learning.

Scribner, S., & Sachs, P. (1990). *A study of on-the-job training.* New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Scribner, S., & Sachs, P. (1991). *Knowledge acquisition at work.* New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Selvin, M., Oakes, J., Hare, S., Ramsey, K., & Schoeff, D. (1990, February). *Who gets what and why: Curriculum decisionmaking at three comprehensive high schools* (MDS-028). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Skrzycki, C. (1992, September 13). Cutting jobs is business as usual with many companies. *New York Times*, p. H-2.

Stasz, C. (1992, January). *Integrating academic and vocational education: A synthesis paper.* Paper prepared for a meeting of the Board of the National Center for Research on Vocational Education.

Stasz, C., McArthur, D., Lewis, M., & Ramsey, K. (1990). *Teaching and learning generic skills for the workplace* (MDS-066). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Stern, D. (1990, November). *Combining school and work: Options in high schools and two-year colleges.* Unpublished paper.

Stern, D., Hopkins, C., Stone, J. R., III, & McMillion, M. (1990). *Quality of students' work experience and orientation toward work* (MDS-318, Reprint Series). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Stern, D., Hopkins, C., Stone, J. R., III, McMillion, M., Cagampang, H., & Klein, S. (1992, July). *Does school-supervised work experience improve the tradeoff between present earnings and likely future career success for high school students?* Unpublished manuscript. Berkeley: University of California at Berkeley, School of Education.

Stern, D., McMillion, M., Hopkins, C., & Stone, J. (1990). *Work experience for students in high school and college* (MDS-167, Reprint Series). Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Stern, D., Raby, M., & Dayton, C. (1992). *Career academies—Partnerships for reconstructing American high schools.* San Francisco, CA: Jossey-Bass.

Tan, H. (1989). *Private sector training in the United States: Who gets it and why.* New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Thomas, R., & Kochan, T. (1990, April). *Technology, industrial relations, and the problem of organizational transformation.* Paper prepared for the Conference on Technology and the Future of Work, Stanford University, Stanford, CA.

U.S. Bureau of Labor Statistics. (1989). *1989 handbook of labor statistics.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Education, National Center for Education Statistics. (1991). *Digest of education statistics, 1990.* Washington, DC: U.S. Government Printing Office.

U.S. Department of Labor, Employment and Training Administration. (1989, November). *Work-based learning: Training America's workers.* Washington, DC: Author.

U.S. General Accounting Office. (1990). *Training strategies* (GAO/HRD-90-88). Washington, DC: Author.

Vaughan, R. J., & Berryman, S. E. (1989, February). *Employer-sponsored training: Current status, future possibilities.* New York, NY: Institute on Education and the Economy, Teachers College, Columbia University.

Whitehead, A. N. (1929). *The aims of education.* New York, NY: Macmillan.

William T. Grant Foundation, Commission on Work, Family, and Citizenship. (1988a, January). *The forgotten half: Non-college youth in America.* Washington, DC: Author.

William T. Grant Foundation, Commission on Work, Family, and Citizenship. (1988b, November). *The forgotten half: Pathways to success for America's youth and young families.* Washington, DC: Author.

Zuboff, S. (1988). *In the age of the smart machine: The future of work and power.* New York, NY: Basic Books.

SUMMARY CHART 1

Development and Implementation of the Options

OPTIONS	DEVELOPMENT OF MODEL	IMPLEMENTATION	
		Full (all elements)	**Partial (some elements)**
Cognitive Apprenticeship	Well-developed	Under design conditions	Widespread but shallow
Tech Prep	Well-developed	Limited but intensive	Partial implementation unlikely
Integrated Vocational and Academic Education	Partially developed, but elements not sufficiently defined.	Limited	Widespread but shallow
Vocational Education as General Education	Partially developed, but elements not sufficiently defined.	Under design conditions	Limited and shallow
Career Magnets	Partially developed, but elements not sufficiently defined.	Moderate but intensive	Partial implementation unlikely
Academies	Well-developed	Limited but intensive	Partial implementation unlikely
Work-Based Youth Apprenticeship	Partially developed, but elements not sufficiently defined.	Under pilot conditions	Widespread, with some intensity
Cooperative Education	Partially developed, but elements not sufficiently defined.	Widespread but shallow	Partial implementation unlikely
School-Based Enterprise	Partially developed, but elements not sufficiently defined.	Not known	Not known

SUMMARY CHART 2

How Well Do the Options Meet the Design Criteria?

OPTIONS	CRITERIA[1]					
	Educationally Rich	**Community of Expert Practice**	**Efficient Learning**	**Work with Employers**	**Clear Training Tradeoffs**	**Prevent Capture by Advantaged Students or Abandonment to Less-Advantaged.**
Cognitive Apprenticeship	Strong	Strong	Strong on individual units; weak on sequences	No relevant design elements		Strong
Technical Preparation	No relevant design elements, but lends itself to absorbing models that are strong on these criteria.		Strong	Moderate, with strong potential	Strong	Strong, but might be perceived as only a sub-B.A. option for less-advantaged.
Integrated Vocational and Academic Education	Strong	Strong	Strong on individual units; weak on sequences	Weak	No relevant design elements	Strong
Vocational Education as General Education	Design elements too unspecified to judge this option on these criteria.					
Career Magnets and Academies	Strong	Strong	Strong on individual units; weak on sequences	Strong	Potential	Career magnets tilt toward advantaged. Academies tilt toward less-advantaged.
Work-Based Youth Apprenticeship	Strong potential			Strong	Moderate	Could be seen as for less-advantaged only.
Cooperative Education	No relevant design elements		Moderate	Moderate	Weak	Tilt toward less-advantaged.
School-Based Enterprise	No relevant design elements		Moderate	Weak	Weak	Tilt toward less-advantaged.

---

[1] This chart assesses the "theory" of the option against the criteria, not as it actually gets implemented.

BUILDING THE MIDDLE:
EXECUTIVE SUMMARY

Sue E. Berryman
Erwin Flaxman
Morton Inger

Institute on Education and the Economy
Teachers College, Columbia University

National Center for Research in Vocational Education
University of California at Berkeley
1995 University Avenue, Suite 375
Berkeley, CA 94704

Supported by
The Office of Vocational and Adult Education,
U.S. Department of Education

December, 1992

MDS-409

FUNDING INFORMATION

Project Title:	National Center for Research in Vocational Education
Grant Number:	V051A80004-92A
Act under which Funds Administered:	Carl D. Perkins Vocational Education Act P. L. 98-524
Source of Grant:	Office of Vocational and Adult Education U.S. Department of Education Washington, DC 20202
Grantee:	The Regents of the University of California National Center for Research in Vocational Education 1995 University Avenue, Suite 375 Berkeley, CA 94704
Director:	Charles S. Benson
Percent of Total Grant Financed by Federal Money:	100%
Dollar Amount of Federal Funds for Grant:	$5,775,376
Disclaimer:	This publication was prepared pursuant to a grant with the Office of Vocational and Adult Education, U.S. Department of Education. Grantees undertaking such projects under government sponsorship are encouraged to express freely their judgement in professional and technical matters. Points of view of opinions do not, therefore, necessarily represent official U.S. Department of Education position or policy.
Discrimination:	Title VI of the Civil Rights Act of 1964 states: "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." Title IX of the Education Amendments of 1972 states: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving federal financial assistance." Therefore, the National Center for Research in Vocational Education project, like every program or activity receiving financial assistance from the U.S. Department of Education, must be operated in compliance with these laws.

INTRODUCTION

Too many young people complete high school equipped neither for college nor for the training required to enter middle-level jobs. What is worse, our nation has no coherent strategy for reaching noncollege-bound students or for helping them develop the competence required for middle-level jobs.

Attempts to create that strategy—which we call "building the middle"—have generated a flurry of learning arrangements and models, and the National Center for Research in Vocational Education (NCRVE) has conducted substantial research on these various approaches. This document is an executive summary of our synthesis of the NCRVE research.

WHY THE SUDDEN INTEREST IN BUILDING THE MIDDLE?

Economic Factors

The full realization that we have to seriously prepare all students emerged in the 1980s. Throughout that decade, the less-educated were increasingly less likely to be employed and, when they worked, earned increasingly less than the better-educated. It is increasingly hard for male high school graduates to earn a middle-class wage.

The wage and employment difficulties of the less-educated reflect a deep shift in demand in the American economy. As American industries convert from mass to flexible production, the need for low-skilled employees is reduced, and the need for better-educated, high-skilled workers increases.

The skill requirements of our economy have changed in two ways: First, analyses of the total occupational structure show us that occupations that need higher-skilled workers are growing faster than those that rely on lower-skilled workers. Second, the skills in many occupations have been restructured: A job may go by the same name, but the skills needed for that job have changed.

The new economy requires the integration of traditionally separate functions (e.g., design, engineering, and marketing), flatter organizational structures, and decentralization of responsibilities. This new approach gives lower-level employees more responsibility and discretion and incorporates into their jobs many supervisory, planning, and quality control functions previously reserved for higher-level employees. In short, skill is more valuable and the lack of skill more of a liability than before.

The Allocation of Educational Resources

The case for coherent, serious education of all students depends on changes in the economy. Changes in the economy have serious implications for education because curricula and learning resources are not organized to prepare students for such changes.

Most comprehensive high schools have no curricular structure for preparing students for middle-skill jobs. Curricula are organized around either college-level preparation or basic skills remediation. These priorities are mirrored in counseling, where attention goes to the more rewarding relationships with high-achieving students or to those with the most severe behavioral and academic problems. Students who are neither high academic achievers nor severe problems simply fall through the cracks.

With increases in academic graduation requirements, vocational education has become nearly invisible in the comprehensive high school. What remains is a tattered and incoherent set of offerings—with only the most tenuous connection to the world of work—serving primarily as places to absorb students designated as "remedial" or "at risk."

THE OPTIONS

Because most American high schools are not organized to prepare nonbaccalaureate-bound students for middle-skill jobs, educators have generated a flurry of learning arrangements and alternative approaches. For simplicity, we refer to these various efforts as *options*. Although the options are not mutually exclusive and elements from different ones can be and often are combined, we define each option separately to help the reader distinguish each one from the others. Our objective is not to select a winner from among them but to provide a template for building a strong school-to-work transition program emphasizing the most valuable components from each of the approaches.

Cognitive Apprenticeship

This option rethinks the nature of instruction and the ways classrooms are organized. It turns the learning situation into a community of expert practice—where instruction is problem-centered, not didactic, and where knowing and doing are integrated. Cognitive apprenticeship transforms the role of the teacher from dispenser of knowledge to facilitator, coach, and guide. It also changes the roles of students from passive, empty vessels receiving knowledge to active participants who take responsibility for their own learning. This option, a modification of traditional apprenticeship, flows from a cognitive science theory of learning about how people learn most effectively and naturally. Cognitive apprenticeship is expected to fit both "vocational" and "academic" subjects. The term "cognitive" should not be read to mean "academic."

Tech Prep

Tech Prep links ("articulates") vocational education in a secondary school to technical education in a postsecondary institution. It aligns vocational and academic coursework into a sequence of courses organized around a work-related education that gives students a set of skills certified by an associate degree as a credential. This credential leads to middle-level jobs. In some Tech Prep programs, the curriculum is designed in collaboration with the business community, and there are often work opportunities at various stages of the program. Tech Prep is generally viewed as the technical education alternative to the college prep program.

Integrated Vocational and Academic Education

This option combines and integrates vocational and academic coursework. It thus eliminates the schism between vocational and academic education. Although it can be done in a number of ways, including team teaching and departmental clusters, this option implies newly designed coursework, reorganization of the faculty, and teacher collaboration. In the ideal or model implementation of this option, students follow a career path incorporating vocational and academic coursework, and vocational and academic teachers are on an equal footing as members of the same faculty.

Career Magnet Schools and Academies

Career magnets and academies integrate vocational and academic education within a theme or focus school. The theme involves an industry such as aviation, agriculture, or fashion. Some career magnets follow the "academy" model as a school-within-a-school; others operate schoolwide. Academic subjects are taught as related functional disciplines. Rather than providing limited job-specific skills, career magnets and academies provide broad generic skills. The school's career orientation grounds cognitive development in a practical, hands-on setting and aligns the curriculum in a way impossible in the "shopping mall" model of the traditional high school.

Academies are always schools-within-schools rather than stand-alone schools. Unlike career magnets, which are open to all students, academies target students thought to be in danger of dropping out.

Career magnets and academies maintain strong collaborative links with local business and industry. Employers from related careers are involved directly in program planning, serve as informal staff (speakers, supervisors, and mentors), and provide summer and school-year employment as part of the curriculum.

Work-Based Youth Apprenticeship

This option, inspired by the German dual apprenticeship system, has four essential components:

1. It is designed to be an integral part of the basic education of a broad cross section of youth. It is not for specific occupations or specific target groups.

2. Its educational content integrates and coordinates vocational and academic content. Apprenticeship programs are designed to teach broad employability skills.

3. A significant part of basic education is to take place on the job, complemented by classroom instruction.

4. This option requires a system of credentials for students who successfully complete the program. These credentials certify achievement for specified levels of skills.

Cooperative Education

Compared to the other options, this one is less formal, is less standardized, and has less well-defined elements. Students usually spend the morning in school classes recommended and approved by the school cooperative education coordinator and the last half of their day working in a paid job for which they receive high school credit. The students do not usually have specially designed coursework, and they attend traditional vocational and academic classes with noncooperative-education students.

Although it uses the workplace as a learning site, cooperative education makes less purposive use of the workplace than youth apprenticeship. While apprenticeship is seen as a first job in a career sequence, cooperative education is often viewed as temporary training.

School-Based Enterprise

School-based enterprise is an activity that engages groups of students in providing services or producing goods for sale (e.g., restaurants, print shops, or auto repair shops). The objectives are to teach entrepreneurship, provide application of skills and knowledge taught in other courses, and enhance students' social and personal development.

DEVELOPMENT AND IMPLEMENTATION OF THE OPTIONS

Table 1 summarizes the development and implementation status of the options. The development column summarizes the extent to which the elements of each option are specified and sufficiently fleshed out to convey a clear image of the model's implementation. The implementation columns distinguish between conscious implementation of the full model and ad hoc implementation of pieces of the model.

For example, the cognitive apprenticeship model is well developed. Its elements are specified and sufficiently fleshed out to give a sense of what an instance of cognitive apprenticeship would look like. However, as a full-blown model, cognitive apprenticeship has rarely been implemented. In partial form, it has been widely implemented. When it appears in partial form, its implementation looks shallow—that is, it does not organize the learning of the whole school but tends to be isolated in specific projects and classrooms.

Table 1. Development and Implementation of the Options

OPTIONS	DEVELOPMENT OF MODEL	IMPLEMENTATION	
		Full (all elements)	Partial (some elements)
Cognitive Apprenticeship	Well-developed	Under design conditions	Widespread but shallow
Tech Prep	Well-developed	Limited but intensive	Partial implementation unlikely
Integrated Vocational and Academic Education	Partially developed, but elements not sufficiently defined	Limited	Widespread but shallow
Vocational Education as General Education	Partially developed, but elements not sufficiently defined	Under design conditions	Limited and shallow
Career Magnets	Partially developed, but elements not sufficiently defined	Moderate but intensive	Partial implementation unlikely
Academies	Well-developed	Limited but intensive	Partial implementation unlikely
Work-Based Youth Apprenticeship	Partially developed, but elements not sufficiently defined	Under pilot conditions	Widespread, with some intensity
Cooperative Education	Partially developed, but elements not sufficiently defined	Widespread but shallow	Partial implementation unlikely
School-Based Enterprise	Partially developed, but elements not sufficiently defined	Not known	Not known

DESIGN CRITERIA FOR BUILDING THE MIDDLE

The overriding objective is easily stated. It is to create learning arrangements that are so highly motivating and so effective that all students develop the knowledge and skills sufficient for middle-skill and middle-wage jobs or for training that leads to these jobs. But how does a learning arrangement have to be structured, and what does it have to do to achieve that objective?

To stimulate discussion of these questions, we offer the following criteria. Based on our immersion in the many studies in this area, we think that these are essential elements. The first six criteria involve the nature of the learning arrangement. The seventh addresses replication and diffusion of the arrangement.

Criterion 1. The option should set up educationally rich and problem-rich learning activities that reflect the knowledge demands of the work contexts in which knowledge and skill have to be used.

This criterion sets two requirements for the learning situation. One is that the situation should mirror what people have to know and how they have to use what they know in the workplace. The other requirement is that the learning activities must develop broadly applicable knowledge and skills.

The key issue for learning is the same for schools and workplaces. A company that organizes work or a school that organizes learning around situation-specific knowledge or as a set of segmented tasks will limit what its workers or its students learn.

Criterion 2. The option should create a "community of expert practice," where the adults do more than talk about the practices of that community and where adults play the role of subject-matter coach during the learning process.

An approach that takes a significant step toward eliminating the division between in-school and out-of-school worlds is what can be called creating a "community of expert practice." These can be created for academic as well as vocational subjects. In such a community, the teacher ensures that the values appropriate to the subject matter (e.g., mathematics or interior design) are respected and that the challenges and constraints of the professional community are present in the learning situation. The teacher, an expert at his or her craft, gradually hands over responsibility for learning to the learners. Learners begin with simple operations as they observe the master's execution of complex skills.

Criterion 3. The option should develop knowledge and skill efficiently.

A learning situation is efficient if it motivates learners to learn more quickly, with greater understanding, and with greater retention and transferability. A learning sequence is efficient if courses are coordinated with each other across the K-12 grades, between secondary and postsecondary systems, and within the postsecondary system.

Criterion 4. The option should engage employers for help in curricular design, the creation of work-experience positions, and commitments to hire the program's graduates.

An active role for employers increases the chances that the learning situation can be updated to reflect what constitutes expert practice in an industry—current technology, modern work practices, and the knowledge needed to make a range of judgments and decisions in that community. The option should also find ways to knit together institutions that develop skills and those that hire skills to ease the transition of students from one to the other.

Criterion 5. The option should make the relationships and tradeoffs among various training investments clear to students.

This criterion is about information. Options should be structured so that they require and generate information to students about

- the payoffs to be expected from investing in training for a particular occupation in a particular program—that is, the wages, the employment opportunities and trends, and the opportunities for advancement;
- the quality of particular training programs; and
- the career paths within families of occupations such as health occupations or the fashion industry. (Options organized around individual occupations do not convey information about career paths. Those organized around a family of occupations do.) In short, an option must not simply provide training; it must also provide information that gives students the power to make informed decisions about their training investments and their careers.

Criterion 6. The option should be designed to prevent its being captured by the more advantaged or abandoned to the less advantaged.

Any system organized around training for middle-skill jobs must be visibly connected to postsecondary education. Parents understand that college—and the academic track that leads to it—is the only path today that gives their children an opportunity for an economically viable future.

However, any system attractive to more-advantaged families runs the risk of being captured by them, which has happened to career magnets in some cities. One way to deal with the problem is to increase the number of such schools—in other words, reduce the scarcity. Another approach is to require each school to accept a specified proportion of students from different achievement levels.

Criterion 7. The option should have the potential to become a national system—that is, it should replicate with quality and diffuse broadly.

The objective is not another marginal program but a work preparation system that has the potential to be national in scale. We ask whether the option itself has characteristics that can impede or enhance its diffusion. We are not dealing with the barriers to diffusion that all educational innovations face but with those that are specific to the option itself.

WHERE ARE WE NOW? ASSESSING THE OPTIONS

How do the options measure up against the criteria? Table 2, summarizing our analysis, assesses the "theory" of each option, not their implementation. For example, cognitive apprenticeship rigorously defines educationally rich and problem-rich learning situations. It also creates a community of expert practice. For these reasons, we judge this option as strong on these two criteria. Because it is highly motivating, we judge cognitive apprenticeship to be strong on the third criterion. However, this option has no implications or design elements that necessarily connect to employers or that inform students about the various training tradeoffs. Yet, there is nothing in this option that would prevent a learning situation from satisfying these criteria. Cognitive apprenticeship powerfully bridges the divide between head and hand and thus undercuts any potential for capture by advantaged students or abandonment to the less-advantaged. For this reason, we judge this option to be strong on the sixth criterion.

Table 2. How Well Do the Options Meet the Design Criteria?

OPTIONS	CRITERIA[1]					
	Educationally Rich	**Community of Expert Practice**	**Efficient Learning**	**Work with Employers**	**Clear Training Tradeoffs**	**Prevent Capture by Advantaged Students or Abandonment to Less-Advantaged**
Cognitive Apprenticeship	Strong	Strong	Strong on individual units; weak on sequences	No relevant design elements		Strong
Technical Preparation	No relevant design elements, but lends itself to absorbing models that are strong on these criteria.		Strong	Moderate, with strong potential	Strong	Strong, but might be perceived as only a sub-B.A. option for less-advantaged.
Integrated Vocational and Academic Education	Strong	Strong	Strong on individual units; weak on sequences	Weak	No relevant design elements	Strong
Vocational Education as General Education	Design elements too unspecified to judge this option on these criteria.					
Career Magnets and Academies	Strong	Strong	Strong on individual units; weak on sequences	Strong	Potential	Career magnets tilt toward advantaged. Academies tilt toward less-advantaged.
Work-Based Youth Apprenticeship	Strong potential			Strong	Moderate	Could be seen as for less-advantaged only.
Cooperative Education	No relevant design elements		Moderate	Moderate	Weak	Tilt toward less-advantaged.
School-Based Enterprise	No relevant design elements		Moderate	Weak	Weak	Tilt toward less-advantaged.

---

[1] This chart assesses the "theory" of the option against the criteria, not as it actually gets implemented.

WHERE DO WE GO FROM HERE?

There are too many options on the table right now; the field needs to eliminate or combine options and focus its energies and resources. One issue the field is struggling with—whether the solution should be primarily work-based or school-based—is not an either/or question; the question is about the solution's center of gravity. Based on the evidence so far, we argue that the center of gravity has to be school-based, with systematic but minor workplace connections.

Beyond a doubt, many school-based programs—even many vocational ones—are divorced from the needs of the workplace, and students emerge from these programs lacking both the knowledge and skills needed at work and information about the ways knowledge and skills are used in the workplace. From the perspective of the schools' failure, a work-based system sounds reasonable. It eliminates the problem of coordinating work-oriented schooling with the workplace because learning and the workplace are coincident with one another. It reduces the school-to-work transition problem for youth for the same reason.

However, if a work-based option solves some problems by virtue of its location, that location raises problems of its own. One major problem is not unique to a work-based system. The evidence is that both schools and workplaces are poorly designed for learning; accordingly, both face the challenge of institutionalizing powerful teaching and learning arrangements. However, a work-based system would require that employers assume heavy educative responsibility for about seventy percent of America's late adolescents.

Traditional social contracts between American employers, unions, schools, and government indicate that the employing sector cannot and will not bear this weight. It might be able to develop and maintain a high quality system that serves a small percentage of eligible youth. Or it might be able to support a larger system skewed toward employers' work, not apprentices' educational interests. Our reading is that for the foreseeable future, the employing sector will not support a national, work-based system that stays focused on apprentices' learning needs.

If the K-12/postsecondary system is to bear the weight of building the middle, it has to be redesigned to provide for all students, not just the college-bound or those who need remediation. To begin that redesign, we propose a national work-preparation system for middle-skill and middle-wage jobs, with the following design elements:

- *The pedagogic and curricular principles of cognitive apprenticeship.* This ensures an educationally rich learning environment, a community of expert practice as the learning situation, a motivating learning environment, and teachers in the roles of coaches. It engages both head and hand, eliminating the separation between vocational and academic.
- *The organizational elements of vocational and academic integration.* These elements need to be in place to implement the pedagogic and curricular principles of cognitive apprenticeship.
- *The articulation and occupational cluster principles of Tech Prep.* Articulation ensures a coherent curricular sequence. Occupational clustering ensures broad training that positions students to move among the occupations, and it creates a cognitive map of how one moves.
- *The rigorous skills certification system of work-based youth apprenticeship.* If employers have a sense of ownership in the system, they are more apt to use its certificates in hiring and wage decisions. If it is rigorous and employers use it, it operates as a quality control on work preparation programs. If it is national, it will create national markets for graduates of the built middle.

These elements can occur in various school-based institutional arrangements: career magnets, career academies, Tech Prep programs, and schools organized around integration principles.

Building the middle will require intelligent and efficient infrastructure to support the process. Beyond the Bermuda Triangle of regulations and rules, the following fundamental areas will need to be redesigned:

- quality assurance mechanisms
- curricula
- professional development
- knowledge flows

All of these have implications at the level of individual schools and school districts, but making these changes will require state or national leadership in many institutional communities, including the assessment design community, employers and trade associations, and schools of education.

Careful attention to the central infrastructure issues mentioned above will lay the foundation for the construction of a quality system. In our judgment, the approach we have outlined capitalizes on the apparent individual strengths of the options being tried today. If well-developed and implemented, this approach might resolve most, although not all, of the design dilemmas. More importantly, this approach offers a coherent strategy for taking seriously the education of all of our nation's students.